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MTM

Journal of Methods-Time Measurement

In This Issue ...

VOL. V NO. 1 & 2 . Jan.-April 1958 MTM ASSOCIATION

MTM

The Journal of Methods-Time Measurement

January-April 1958

MTM ASSOCIATION FOR STANDARDS AND RESEARCH

The Journal of Methods-Time Measurement is dedicated to the technical aspects, application developments and general news items concerning the advancement of MTM.

The Journal encompasses the fields of endeavor that were formerly publicized in the MTM Newsletter and MTM Bulletin.

The technical section of the Journal is concerned chiefly with recent research developments both from the established research program at the University of Michigan, Ann Arbor, Michigan, and from somewhat smaller allied projects being conducted throughout the Association membership.

New applications of MTM as well as refinements of established applications are presented in the Application Section to illustrate specific approaches to management problems that can be solved through the use of Methods-Time Measurement.

Current events in the lives of persons associated with MTM are described in the general news section.

The Editorial Staff welcomes contributions for all three sections described.

MTM

The Journal of Methods-Time Measurement

January-April 1958

MTM Association

Editor.......................... Richard F. Stoll

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January - February - March - April

** ANNOUNCING **

7th

ANNUAL INTERNATIONAL
MTM
CONFERENCE

Hotel Statler New York City

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SEPTEMBER 24 - 25 - 26, 1958

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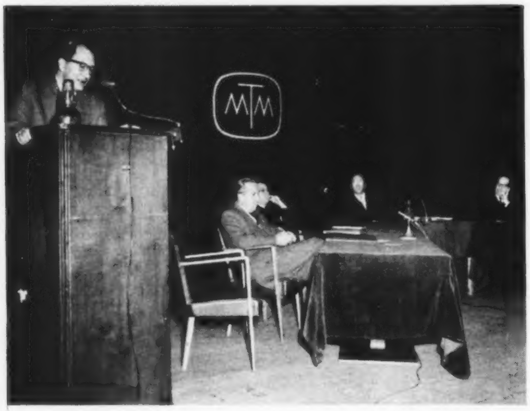
Find out how your company can improve its competitive position by having control programs in Clerical, Maintenance, etc. Other subjects planned are: Product Planning, Problem Solving, Training, Integration of Research Findings, etc.

FEATURE I

MTM CONFERENCE NOVEMBER 28, 1957
Utrecht, Nederlands

MTM IN NETHERLANDS -

November 28 last the Netherlands M.T.M. Association celebrated their fifth anniversary with a well-attended conference in the Municipal Theatre of Utrecht, concluded by a private dinner for the members.



Mr. O. Martz of Switzerland, giving Swiss MTM case-history. At the table you will see from the left to the right Mr. A. Strachoff (Director of Methods Engineer Department Unilever). Mr. G. Lapoirie (representing the French MTM Association), I. R. Volz, P. A. G. Volkers (chief engineer of Univers and chairman of the Technical MTM committee).

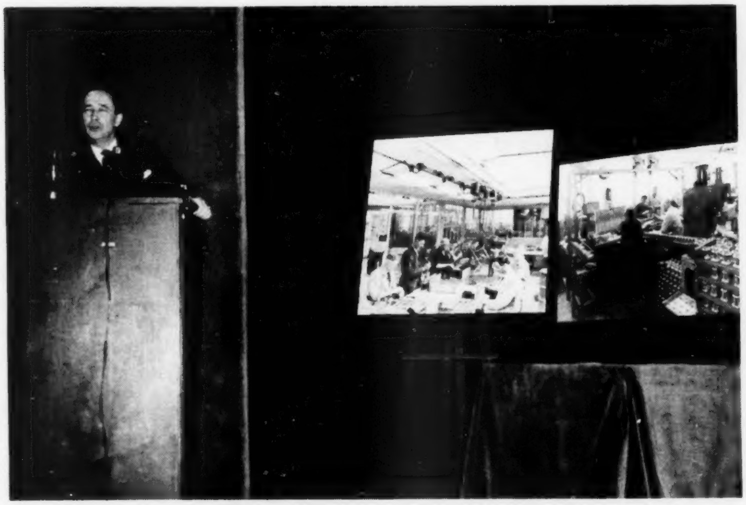
After the opening of the morning session by Mr. Ir. R. F. Volz, president of the Association, Mr. Ir. A. Strachoff explained in a general introduction the importance of M. T. M. for industry. In the past five years the expectations about the growth of methods of predetermined times have been fully realized. Especially in the field of methods analysis and the establishing of standards good results have been achieved. Methods analysis must be connected with looking at all sources of loss through a magnifying glass. When all major demands made on the methods engineers have been met, a better establishing of standards will follow of its own accord. Estimating of times gets superfluous and faster measurement is possible. By-products of M. T. M. are better cost-rating for new operations, decrease of learning time, maintenance of standards a. s. o. Finally, M. T. M. can be used in departments where the stopwatch method will meet serious psychological problems (clerical work).

Mr. Ir. A. R. Blok gave a very interesting lecture, illustrated with pictures, about the use of M. T. M. in construction and mass-production. In a very explicit way a case was discussed which proved that after application of usual efficiency methods, M. T. M. can still lead to further economies.

Mr. O. J. Da Silva explained the influence of M. T. M. on the development of technicians in the practice of industrial life, especially with regard to motion-consciousness, analysing and respect for machines and tools. Moreover, M. T. M. is standardized internationally and its newness is of importance to technical education in the Netherlands. The danger exists, however, that M. T. M. may be used as a panacea, as for instance has been the case with T. W. I. M. T. M. is another tool in the kit and has to be used where it is necessary. Apprentices ought to be, first of all, inducted into the field of efficiency, to which M. T. M. belongs as another aid. The profession ought not to stick in trifles.

In the afternoon session a panel formed by Mr. F. Mayer, chairman, and Messrs. J. deGraaf, Ir. A. Strachoff, Ir. A. R. Blok, D. J. DaSilva, Ir. A. G. van der Hoek, Ir. P. A. Jellema and Ir. J. A. Borggreve, answered a number of questions presented in writing.

Conference Paeticipants



Mr. Ir. A.R. Blok, managing Director of Becker's Sons behind the desk, giving his lecture on the problems of assembling back-pedalling brakes for bicycles, with the aid of two enlarged photographs showing the assembly line before (left) and after (right) studying the problem with MTM.

The first one was a ticklish one: "Why do not all practitioners of predetermined time methods unite? Is M.T.M., moreover, the best method?", with a reference, naturally, to Work Factor, which method has been also introduced into the Netherlands. The panel answered very modestly that M.T.M. is a good method; "the best method" does not exist because relevant application in all kinds of different cases has to be taken into account.

On the question how far M.T.M. has to penetrate into education, was answered that interest in man at work in cost-consciousness is growing. In that framework attention has to be paid to M.T.M. on a modest scale; it has, however, not to be considered as an indispensable walking stick on the technical path of life. Those who get into touch with it in practice, are still in the position to follow the courses, which the Association gives in three grades of intensity.

Another question concerned the testing of machines by M.T.M. and showed that M.T.M. has still a wide field of action in prospect and that propaganda has to be intensified. For that matter, this applies to methods engineering in general. As long as it is impossible to get into a chilipepper-pot with a normal table knife, one ought to be cautious with the application of M.T.M. and use some cruder methods first. For the building of sewing machines and for packing M.T.M. has been applied already.

M.T.M. is two-sided: establishing rating standards and improving work methods, which demand teamwork. The danger is not imaginary that M.T.M. will be used injudiciously.

The technical committee of the Association tried to check as much as possible irresponsible application by elevating those who practice the profession and by checking M.T.M. times repeatedly by watch.

Further was stated that M.T.M. cannot alter anything in processing times, that it is applicable to office work and that it has its uses in construction industries with long work cycles. In this connection Mr. R.M. Crossaw, one of the oldest collaborators of Maynard's,

Mr. L. Bootsma of the printing firm of Joh. Enschede & Sons of Haarlem pointing with a stick to the MTM-analysis of inserting the inner pages in the cover of a magazine.

told that in the U.S. M.T.M. is used frequently for indirect work, which method means an important time-saving. In Europe too long work cycles ought to be measured in this way.

Two other foreigners took the floor too. Mr. G. Lapoirie of the French M.T.M. Association gave a picture of the development in France, where in the past years 700 experts have been trained, coming from various industries. Mr. O. Martz from Zürich told about the growth of M.T.M. in Switzerland, where assistance is given by the Federal Technical University.

Mr. J. de Ruyter of the Netherlands Agricultural Research Institute showing the operation of a planting machine.

In the lobby of the theatre some very successful demonstrations took place regarding the application of M.T.M. to the following operations: putting cops into the magazine of an automatic loom, changing spools on a loom, centering a bolt, changing mimeograph stencils, completing pipe-coupling-fittings, waxing the ends of iodine-tubes (for airtight closing), marking place of pockets on ready-made clothing with four pins respectively with staples, operation of planting-machine, inserting the inner pages in the cover of a magazine (demonstration of application of time formulae), preparing the packing of margarine-blocks.

Mr. Ir. Volz closed the conference and pictured the place of M.T.M. in the general aspiration for efficiency as such. The growth of M.T.M. is clearly illustrated by the number of experts who passed the examinations successfully, viz. in 1955 - 22, in 1956 - 65, and in 1957 - 155.

Mr. A.H.M. Langezaal of Unilever Rotterdam demonstrating the way of folding a wrapping for margarine blocs.

The complete operation was also shown by means of a film-strip. The film projector is seen in the foreground.

FEATURE II

WHAT COMPAGNIE INDUSTRIELLE DE TEXTILES ARTIFICIELS ET SYNTHETIQUES (C. T. A., FRANCE) IS DOING WITH MTM.

by

M. Roger Cazals
Organization Division
C. T. A.
Paris, France

C. T. A.'s chief manufactures, by what is know as the VISCOSE process, are:

Rayon textile yarn
Rayon staple fiber
High Tenacity rayon tire yarn

In addition to manufacturing, C.T.A. is active in the technical and administrative management of several other companies, all of them engaged in manufacturing or converting products derived from cellulose, by this same VISCOSE process.

C.T.A. employs 11,750 persons in its thirteen plants located throughout France. The personnel of each plant ranges from 450 to 1,500 employees.

Its Central Division of Organization and Labor coordinates and promotes all questions of interest to organization and labor.

In the Spring of 1952, during a Franco-Belgian convention of the Man-Made Fibers Industries, six C.T.A. engineers (five from ORGANIZATION, one from the Planning Division) were trained in M.T.M. procedure by American experts.

What role has M.T.M. played since that time in the over-all activities of C.T.A.'s various enterprises? To answer this question with a fair degree of accuracy a distinction must be made between the two main aspects of M.T.M.: its technical aspect, and its psychological aspect.

In so far as its technical aspect is concerned, C.T.A.'s endeavors will be better understood when it is learned that during the past five years thorough training in M.T.M. procedure was given to thirty-eight engineers, twenty-seven of whom came from ORGANIZATION. However, inasmuch as ORGANIZATION is often little more than a temporary period at the outset of C.T.A.'s young engineers' careers, and since seven of the thirty-eight engineers trained in M.T.M. have by now left the company, the present situation is as follows:

<u>31 engineers trained in M.T.M.</u>

1 Plant Manager
16 Technical Managers
1 Administration
1 Training
8 Manufacturing
3 Planning
1 Maintenance

In addition to the above M.T.M. training was given, for C.T.A.'s Organization departments, to twenty-five technicians, all of them specialists in Operation (timing, work simplification, remuneration). Which means that fifty-six persons employed by C.T.A. are now thoroughly familiar with M.T.M. technique; and among them forty-two occupy positions which call for the utilization of this technique. It would be exaggerated to say that M.T.M. has become a routine part of the work of these forty-two persons. Actually, some of them make but scant use of it. But in the Organization departments it has by now become an additional resource which is gradually taking its place among the standard techniques of analysis and planning. At the present time it is especially valued in two fields, both of them closely related.

In the first place M.T.M. is used in the examination of new manufacturing processes, new installations, new equipment. The industry in which C.T.A. is engaged is a highly progressive and competitive one; and progressive methods are imperative, not only in the interest of general economy as they are in all industries, but, in this specific industry, to meet the challenge of a market constantly flooded with new products.

Every manufacturing change, every technical improvement, every launching of new equipment raises a problem of cost and its attendant problems of organization.

C.T.A. finds M.T.M. an invaluable tool whenever it is instrumental in supplying Technical and General Management departments with factors of evaluation and choice that are made

possible by M. T. M.'s close approximation of labor costs, of equipment, of transformation, etc.

During the past two years C. T. A.'s Central Department of Organization has been more and more often consulted on questions to which sufficiently accurate answers can be given only by applying M. T. M. techniques. Besides, similar problems arise constantly in each of the plants and particularly in those dealing in diversified products for which manufacturing methods or the presentation of manufactured products themselves undergo frequent changes. One particular plant, for instance, by reason of the variety of products manufactured and the consequent variety of presentations required, is akin to the converting industry where operation is on a unit rather than a mass production basis. In this particular plant the 3rd T.W.I. or F.P.C. program and the suggestion-box system were highly successful; and M. T. M. proved a useful adjunct in problems of organization. The creation of new positions, too, and the development of new products are improved and expedited by the application of M. T. M. techniques. And in practically all fields where they are applied they contribute to work simplification. Readers of this article are however familiar with these advantages and they do not need to be stressed further.

C. T. A. believes not only in M. T. M. training but in what they call M. T. M. Information. Consequently they make a conscious effort to inform as many executives and co-workers as possible on what M. T. M. means and what is expected of it in their business. With regard to this psychological aspect of M. T. M. to which reference was made earlier in this article, let it be said that a tremendous effort has been made over the past few years in the field of Information. To this end, engineers, supervisors, and technicians meet at regular intervals for General Information courses on C. T. A.'s manufactures and technical improvements.

Within the program of technical improvements, a rotating series of Information courses on C. T. A.'s methods of work analysis was initiated five years ago. This innovation, psychological rather than properly technical, was found to be highly remunerative—the quasi-impossibility of tabulating psychological results notwithstanding. Actually it was at the request of the first M. T. M. "initiates" that C. T. A.'s Central Division of Organization decided to give wider scope to this innovation. It resulted in bona fide conversions and in an appreciable change of atmosphere in the plants where closer relationships sprang up between workers and a pleasanter understanding was fostered between Organization and the other departments.

To date, thirty-four Information courses have been given, each with an attendance of some twelve listeners. Eighteen of these courses were given for managers and engineers; sixteen for technicians and foremen. Which means that Information courses in work analysis were provided for:

- 15 Plant Managers or Department Managers from the main office
- More than 200 Engineers
- About 180 Foremen and Technicians specialized in various branches

Each course lasts approximately one week for executives, and two weeks for assistants. The teaching method is brisk and the program fairly exhaustive. Information on M. T. M. may require one, two, or three days, dependent on the student, and represents approximately one-fifth of the time devoted to the entire course.

In spite of the fact that C. T. A. calls these courses "Information on Work Analysis" they have come to be known throughout the offices and plants as "M. T. M. Training Courses," which is clearly indicative of the impression left on the participants. And there is of course not the slightest doubt that M. T. M.'s share in the success of the courses is a major one. Its role as a means of work simplification (either within the scope of courses of this type or the 3rd T.W.I. or F.P.C. programs) is actually of lesser consequence than the beneficial impact it exerts on the minds of persons who are not usually involved in problems of work analysis.

Even though the three engineers from C. T. A.'s Planning Division who received complete training in M. T. M. (and the more so the other ten who attended only Information courses) may not use M. T. M. procedure as an integral part of their daily routine, it has nevertheless deeply affected the way they go about their work. As a rule, C. T. A. planning technicians, who are experts in such matters as the resistance of materials, analytical and applied mechanics, and the utilization of fluids, are not sufficiently aware of the fact that the equipment and installations they are working on will have to be used by the personnel. An M. T. M. training course changes their views on the subject. So much so that M. T. M.-trained engineers are insisting that similar training be given to their designers. And it is becoming manifest that among the details of projects open to criticism

a large number would be avoided had the designers received M.T.M. training.

A few more remarks on the psychological aspect of operation study will be useful.

The absence of any mention of the application of M.T.M. technique to task assignment and remuneration may appear surprising. A simple statement of one of the basic features of C.T.A. will clarify what might otherwise seem to be an omission: In the C.T.A. group, questions of work organization and efficiency remuneration, however technical they may be, have always remained closely associated with human problems. The Central Department of Organization is responsible, in addition to organization problems, for labor problems. As such it is part of Personnel Management, and at the same time subordinate to Industrial Management for problems of organization. In the plants, Organization engineers have certain labor responsibilities, among which is the training of personnel. They are also responsible for questions connected with remuneration and salaries. This brief remark will tend to clarify the spirit in which C.T.A.'s organization of work is conducted; and it will explain the fact that technical and social aspects of operation study remain, at all times, closely associated.

For about fifteen years the organization of C.T.A.'s various workshops and the establishment of what is called "remuneration rates" have been studied in committees, be they organization or workshop committees. Consequently the personnel is well acquainted with the way these problems are handled and often actually contribute to the work.

Representatives selected by the personnel are trained in C.T.A. techniques. They often take part in the work and in any event are able to verify its sincerity of approach.

A few words must be said about vocational training which also provides a valuable field of application for M.T.M.

Every person responsible for training has received at least the information mentioned above. Still it is C.T.A.'s desire to provide them with more complete training in M.T.M. technique. Plant instructors are technically dependent upon the Organization engineer. There is no clear-cut delineation between operation study and vocational training; and this again is a feature of C.T.A.'s ever-present desire not to dissociate technique from the human problem.

One result of vocational training is the possibility of obtaining proper workmanship, that is workmanship that is sensible, reliable, economical, and top grade. Another result of vocational training is that all workers skilled in given tasks are capable of high output which makes it possible for them, without undue fatigue, to achieve maximum production and reap the harvest of worthwhile bonuses.

M.T.M. is a valuable tool for the instructor because it provides an analysis of motions conforming to the one given by Operation Study experts. It clarifies the kinetic processes, avoids omissions in descriptions of motions, shows the advantageous grouping of motions, and even explains how to acquire certain stratagems in this field. M.T.M. is moreover a sort of common language between instructors and analysts, a language which was lacking in the past. Action in this field will consequently be pursued by C.T.A. in the coming years.

In conclusion, C.T.A. has found in M.T.M. an added means toward efficiency in work analysis. It is a tool that was sorely lacking in the past when reliable decisions were needed in connection with new technical methods, new equipment, and new installations. It is invaluable in starting new productions, setting up new working-posts and converting existing ones, because of its close approximation, right from the start, of the best and most advantageous method possible.

The use of M.T.M. will be further developed in C.T.A.'s Planning Division and Personnel Training departments; and the possibility of its being eventually used for task assignment and remuneration is not excluded.

In an effort to reap the maximum benefits from M.T.M. and in the hope of seeing its techniques fully appreciated by the entire personnel, C.T.A. will strive to enrich its experience and will stand guard against the possibility of outside blunders discrediting so valuable an asset.

C.T.A. has, from the start, for its own enrichment as well as the protection of M.T.M., given its unfailing support to the French M.T.M. Association to the very best of its ability.

FEATURE III

COOPERATION OF PLANTS IN WORKSTUDY ON THE BASIS OF MTM-DATA

G. H. Vloedbeld
Raadgevend Bureau Ir. B. W. Berenschot N. V.,
Hengelo (O), Holland

In Holland several manufacturers in the same branch of industry have their analysts set up workteams in order to study jointly workmethodproblems. Among others there is a ready-made clothing group, a packing group and some textile groups.

The object of this cooperation in several cases is

1. to achieve mutual instruction in order to improve the use of MTM
2. to give the analysts the opportunity to exchange views
3. to exchange method and time data.

I will try to tell you something about the recent experiences of one of the textile groups. They agreed on the study of "changing bobbins" on Leesona warpyarnwinders.

Before I tell you about this study it will be good to give a short explanation of the principal function of a warpyarnwinder in a textile mill. This object  is called a bobbin. It is the raw material for the Leesona winder. The product is called cheese and looks like this  The machine has a double function. First it must clean the yarn and after that it must convert bobbins into cheese. On wall-picture number 1 you will see a schematic side view of a Leesona.

"Change bobbin" is the main element of the work of the operator on a warpyarnwinder and it takes about 70 - 80% of his time. A bobbin is put on a pin (A). Several of these pins are side by side on the machine. The yarn is brought over the yearncleaner (B) and is taken along the back of the stop motion (C). After that the yarn is tied up with the cheese (D) which is on a moving spindle (E). When this is done the machine can be started. When the bobbin is empty the operator removes it and a conveyor belt carries it off.

At the same time the operator puts up a new bobbin. I hope that this description of the element "change bobbin" will be sufficient to follow the thread of the story.

The procedure of the study was as follows.

Every analyst made a complete analysis of the element in his own plant and stated, in which way the element was performed given the technical circumstances and quality specifications in his plant. This being done the members of the group came together to discuss the various analyses and to try out to set up the best method. This discussion yielded an important point of profit for the MTM-system. For it appeared that comparing the plants several factors differed rather and as a consequence also the workmethods differed from plant to plant. This mutual explanation required a great deal of time but thanks to the sharpness of the MTM-study the analysts were able to explain these differences completely. And I must say that such a detailed explanation would not have been possible with the classic timestudy technique.

On wall-picture number 2 you will see the time results of the analyses of the different plants. Times are measured in T. M. U. that is one hundred thousand of an hour.

When you look a moment at the differences in time you can see that the differences between the sub-elements of the different plants are bigger than the differences between the times for the complete element.

These time differences were due to differences in technical factors as I mentioned.

You may find an outline of these factors on wall-picture number 3.

Although it would be interesting especially for the textile people amongst you to go into detail, I must leave off because in that way the discussion would become too technical for the other part of the audience. For a better understanding however I will mention a few of the most important factors.

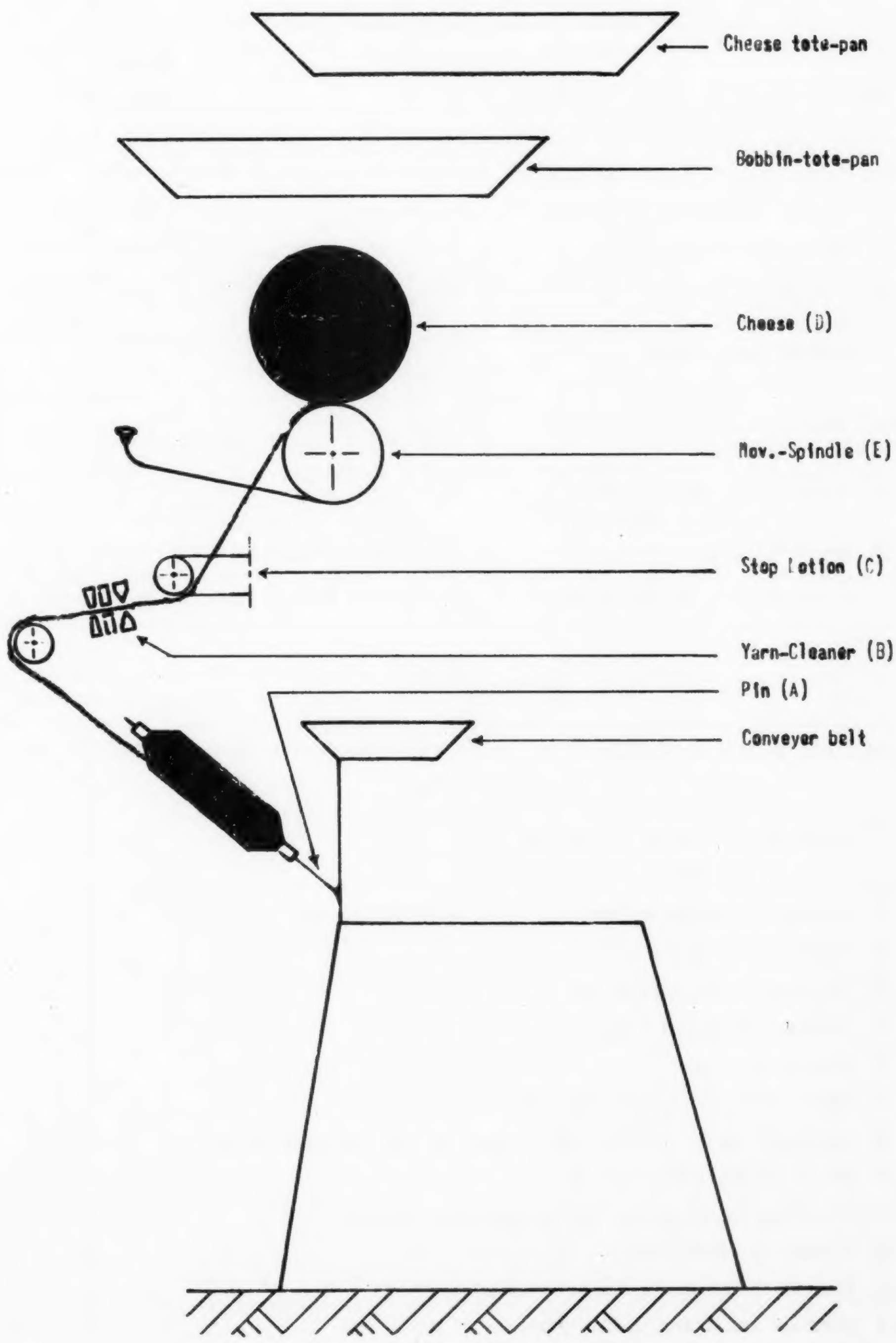
Number 2: the place of the tote-pans influences some reach and move distances

Number 5: the position of the thread-end on the bobbin is important because it determines the time required for grasping this end

Number 15: the method of knotting is a factor

PICTURE 1

SCHEMATIC SIDE-VIEW OF THE LEESONA WINDER



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FEATURE III

PICTURE 2

OUTLINE OF M.T.M. TIME FOR THE ELEMENT "CHANGE BOBBIN" ON LEESONA IN T.M.U.'S

Parts of element / Plants	A	B	C	D	Minima
1. Remove empty bobbin	32,5	$\boxed{18,8}$	34,8	35,8	18,8
2. Grasp bobbin from tote-pan	29,-	27,-	$\boxed{20,5}$	22,8	20,5
3. Grasp thread-end of bobbin	28,-	40,3	$\boxed{27,2}$	31,7	27,2
4. Wind off thread	14,7	18	20,2	$\boxed{9,4}$	9,4
5. Put bobbin on pin	28,-	31,4	$\boxed{15,5}$	22,3	15,5
6. Take thread over cleaner and behind stop-motion	30,2	30,8	18,-	$\boxed{11,2}$	11,2
7. Break thread	18,8	-	-	-	-
8. Search thread-end on cheese and grasp it	31,8	41,5	58,5	$\boxed{30,7}$	30,7
9. Knot thread-ends (hand.) " " (mach.)	82,7 -	- 40,-	- $\boxed{21,2}$	$\boxed{31,2}$ -	21,2
10. Start machine	$\boxed{8,2}$	32,7	18,7	26,4	8,2
Total time	303,9	280,5	234,6	209,3	162,7

PICTURE 3

FACTORS WHICH INFLUENCE METHOD AND TIME OF THE ELEMENT: "CHANGE BOBBIN"

1 Depth of the bobbin - tote-pan.
2 Place of the bobbin - tote-pan.
3 Number of empty bobbins on each other on one pin.
4 Graspability of the bobbin.
5 Position of the thread end on the bobbin.
6 Number of thread-turns around foot of bobbin.
7 Degree of twist.
8 Space between pin and yarn-brake.
9 Diameter empty bobbin with respect to the diameter of the pin.
10 Fit of empty bobbin on pin.
11 Construction of brake, knives and stop-motion.
12 Quality of thread-end.
13 Length of the loose thread-ends of the knot.
14 Number and color of the yarn.
15 Method of knotting and required knot.
16 Strength of yarn.

because it makes a difference whether the thread-ends can be tied up mechanically or whether they must be tied up by hand.

When these factors were known the group for fun set up a minimum time for the element. Thus you can see on wall-picture 2 in the column "minima" the minimum time for the element "change bobbin".

These minima had the effect of working as a challenge. More or less in the way of "Why not beat this minimum". In practice this minimum time will only be reached under the most ideal circumstances because the factors influence each other. For if the effect of one factor is improved the effect of another factor may worsen.

So at first sight this minimum time seems to be somewhat theoretical. Nevertheless the great practical merit of analysing these factors and setting up the minima was not the finding one best method but the fact that every analyst of the team saw enough points which were worthwhile examining in his plant and every analyst got enough information to achieve for his plant the most efficient compromise between the factors and in this way to find his best method and timestandard.

If we put together the results of this study and we ask ourselves whether in general it is useful to have MTM-analysts cooperate in this way, we must answer this question with "yes".

Especially because of the following reasons:

1. The quality of the MTM-analyses will be improved because more analysts put in their knowledge and this means in itself a direct result. Of course this cooperation must also lead to improvement of the analysts themselves.

2. When searching for efficient workmethods more will be achieved by a group of plants than by one plant because each brings in his knowledge, experience and gadgets and everyone can benefit from it.

3. It is our experience that in the area of workstudy only cooperation of plants on the base of MTM will yield results, for in comparing data one always has to scrutinize details, and MTM gives the opportunity to do this in a systematic way.

In the long run the reaction of industry is the best measure for the value of new ideas. In Holland the first MTM-application started in 1952. Now five years later a lot of plants are using it and many analysts meet each other in work teams as mentioned.

I thank you for your attention.

MARCH, 1958

Whirlpool Parade

TRAINING

BY GORDON QUIMBY, *Methods Engineer*

WHAT IN THE WORLD IS HE DOING?

Reprinted from March, 1958 issue of WHIRLPOOL PARADE

YOU CAN USUALLY CREATE A PRETTY GOOD FIGHT IF YOU START people arguing about time studies and production rates. One of the things that is most near and dear to our hearts is the answer to the question, "How much work do I have to do in order to earn my wages?" And often a loud difference of opinion develops concerning what a *fair* rate should be.

The time study people in our plants now have available a rather interesting and entirely different system of making time studies and setting production rates. This new technique is called MTM. This abbreviation stands for Methods-Time Measurement. It is one of the most accurate ways of measuring work time that could possibly exist.

You will notice the time study engineers using this new method more and more in the factory. And when you see one of them using it, sometimes you will wonder, "What in the world is he *doing?*"

Look! There goes one now, on his way to make an MTM study. Let's follow him and watch what he does. You'll see what I mean.

There he is now, making a sketch of the workplace . . . and now he is watching the operator work . . . now he is writing on some paper . . . he stops writing occasionally to talk with the operator . . . boy, he is writing a *long* time . . . page after page . . . sometimes he is writing without even watching what the operator is doing.

George Stephens WEIGHING Base Plate with spring scale . . .
"It takes longer to move something heavy than something light."

See now, here's what I meant. He's starting to act a little queerly. He's hovering around the workplace, picking up small parts and laying them aside again and again, while his face wears that "faraway look." Now he's dangling that large part from some kind of weighing scales.

The operator has stepped aside now and the time study man is in there himself, measuring everything. He's even waving his arms and measuring how far he's waving them. The other operators in the area are grinning, nudging each other, and drawing "screwball" circles in the air beside their heads. Boy, that tapeline is really taking a beating!

Now he's inserting parts and taking them out again and again, muttering to himself, and making more notes on his papers. And the same thing with the hand tools; pick them up, use them, and lay them down, all in slow motion, over and over again.

Look at him now! He's stomping around the workplace, stepping on the foot pedal, and rocking and twisting his body back and forth.

WHAT IN THE WORLD IS HE DOING?

Now he is turning to the operator, asking him a few more questions about the job, and allowing him to go back to work. The operator is running out of parts. The time study engineer is pulling his stopwatch from his pocket and timing the man as he replenishes his stock. More notes on the papers.

He has gathered up all his equipment now and is ambling off toward the Time Study Office. Let's follow him and find out what this is all about.

As we enter the office, we see him sitting at his desk with his MTM Data Card in front of him beside his papers. This Data Card was sticking out of his hip pocket all the time he was out in the plant, but he only glanced at it once or twice. Now he is referring to it constantly as he writes figures on his papers.

Come on, let's go over and ask him what he's been doing. I'll talk to him. I'm not afraid of him 'cause I know just how to handle these guys. All you have to do is call them "Industrial Engineer" and it makes them so happy they become as putty in your hands.

Me: Hey, Mr. Industrial Engineer. What's the rate gonna be on that job?

I. E. (leaning back in his chair and grinning): I'll be darned if I know.

Me (surprised): Weren't you just out in the plant taking a time study on it?

I. E.: Well, not exactly. I was making an MTM Analysis of it.

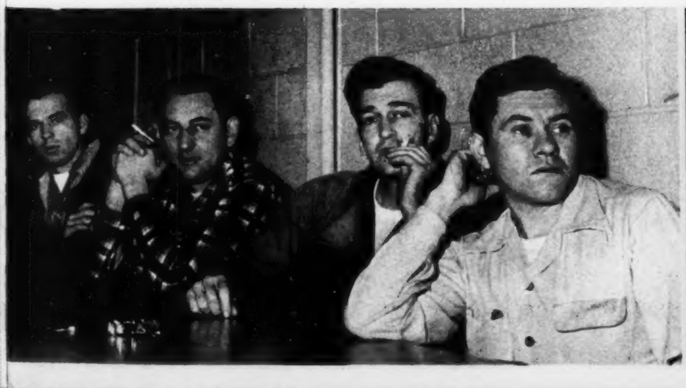
Me: Analysis, schmanalysis! Where's the time?

I. E. (still grinning): Right here on this card.

(He waves a Data Card under my nose. Unbelievingly I take the card from him and look at it. I see that it has a lot of tables of information on it with titles like "Reach, Move, Grasp, Position, Disengage, Apply Pressure, Release," etc. Under each of these headings I see a mass of figures and descriptions.)

Me (confused): Perhaps, O Mighty Engineer, you would be good enough to explain?

I. E.: Sure 'nuff. You see, you can find listed on this card every motion that is made out in the factory in doing work. All the motions used in reaching, picking things up, walking, lifting, body motions like bending and sitting and kneeling, assembling, hammering, turning things, yes, even focusing the eyes like in an inspection operation. Every job we do is simply a long combination of these motions on this card.



GORDON QUIMBY, Methods Engineer and author, was in the last Parade tho' we didn't know it. For it was Gordon who method-time measured Herman Kieffer's job so well Herman said, "He's the only Time Study man I've ever trusted in my life." Great tool! Ah, but the man!

Two more ardent converts to MTM would be hard to find than Gordon and Dick Bailey who are co-teaching our courses. Dick formerly worked where MTM originated. And on our cover are the tools described in Gordon's article which make MTM the fairest work measurement method yet known to man.

Me (amazed) As I live and breathe!

I. E. (laughing) No, breathing isn't listed. But you will notice something else listed on the card that is *very* important.

Me (curious): What's that?

I. E. (pointing with his pencil on the Data Card): All these figures that are listed under each motion heading. They show the amount of time that it takes the average worker to make each motion. All you have to do is list all the motions, look on the card to find the time for each one, and add them up.

Me (seeing the light): Oh, that's what you meant when you said you didn't know what the Rate would be. You hadn't added up the times yet.

I. E. (nodding): That's right. When I was analyzing the job out in the shop, I was only interested in what the operator had to do, not how long he took to do it.

Me (looking at the card carefully): Yes, but there must be over 300 figures on this card. How do you know you are picking out the right ones?

A man at the next desk turns to me and says: Great Guns, don't ask him that. He'll talk for a year!

I. E. (giving him a withering look): Please ignore my uncouth colleague. To get back to your question about picking out the right time values, this isn't very difficult once you have really studied MTM. And believe me, the midnight oil we burned studying this subject would fill a lot of gear cases.
(Pointing to the card again) We not only list each motion on an Analysis, we also classify it in several ways. Here, let me show you on this Analysis I just did. See, this M 8 C shows that the worker moves an object. I also had to measure how far it is moved. Actually, it ended up only about 7 inches from where it started, but because his hand moves in a curved arc I gave him

Robert Koch measuring with tapeline.
"I also had to measure how far it is moved . . . I give him credit for the extra distance . . . when his hand moves in a curved arc."

credit for the extra distance and made it 8 inches. I also had to decide what classification of Move it is. We call it "Case." He is moving it to a pretty exact location so I called it a Case "C." This type of Move takes a little longer than the other kinds because a little more care is required.

Me (warningly): You're losing me, boy. You're losing me. What about the time figures?

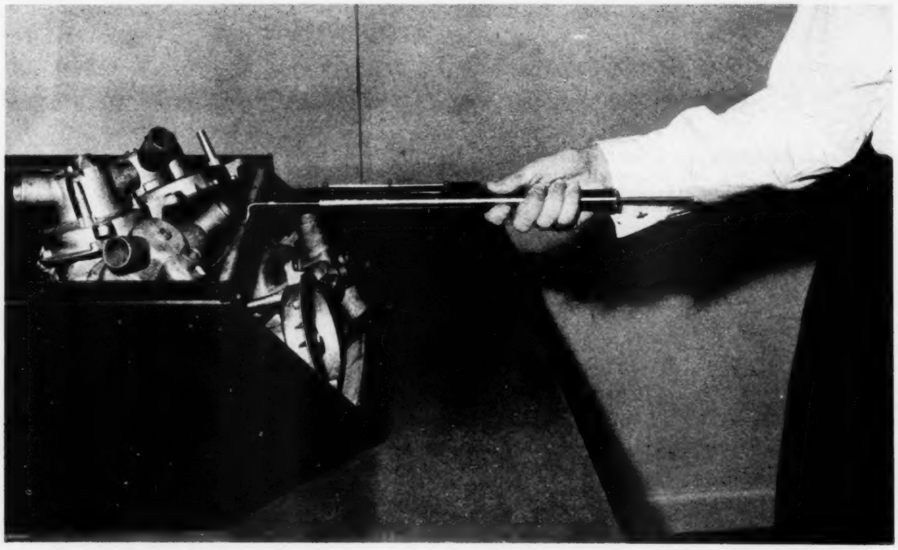
I. E.: It's simple. Now that we know that the motion is a Move, that it is 8" long, and that it is a Case C, we just look on the Data Card under Move, 8 inches, Case C, and there's the time, 11.8 TMU. See?

Me: Yeah, I see . . . no, I don't either. What the dickens is a TMU?

I. E.: Well, a TMU is a Time Measurement Unit. We use them instead of seconds and minutes.

Me: What's the matter with seconds and minutes? A lot of people use them.

I. E. (laughing): Nothing's the matter with them. We convert the TMUs to minutes in setting the Production Rate. But with MTM we deal with such small amounts of time that we would have to monkey around with an awful lot of decimal places. For instance, this Move we were just talking about takes .00708 minutes to perform. One of the simple Grasps requires .00120 minutes. You can see that tossing about a hundred or more figures like those around on an Analysis would get kind of rough. So we use TMUs up until the end and then convert 'em to minutes. The time comes out the same either way.



. . . *PULLING with spring scale.* "We multiply the regular Move time by the proper factor . . . The heavier the weight, the bigger the factor . . . We add some more time for the operator to tighten his grasp . . ."

Me (doubtful): I still think there's something fishy here. It takes longer to move something heavy than something light.

I. E. (reaching into his cluttered desk drawer): Indeed it does! The times on the card are only good for things that weigh less than 2½ pounds. This spring scale is used to weigh heavier parts.

Me: So you weigh them. So what?

I. E. (pointing on the Data Card): Here is a section titled "Weight Allowance." We multiply the regular Move time by the proper factor in this list. The heavier the weight, the bigger the factor. And after that, we add some more time to allow the operator to tighten his grasp on the part (he's already got hold of it) so that he can move it safely.

Me: Give me a f'rinstance.

I. E. (scribbling and slideruling rapidly): Well, the part that the operator is moving in this analysis weighs 2 pounds and it takes 11.8 TMU to move it. If it weighed 11 pounds more it would take . . . lessee now . . . exactly 19.4 TMU to go the same distance. Understand now, this is just moving it, not taking hold or letting go.

Me (surprised): Gee! That's over half again as long. That seems fair enough.

I. E.: That's exactly what it is. Fair. Everything the operator has to do which takes time is allowed for in the Analysis.

Me: This is real interesting. Give me another f'rinstance.

I. E.: Well, I could give you a lot of them. "F'rinstance" there are 11 different ways that a worker can grasp an object. The Card shows the time for each one. And sometimes the worker uses more than one kind of Grasp in picking up an object. We can detect this and we allow the time for all of them.

There are more than 18 different kinds of Position. These are just the tiny motions used in simple assembly or in lining things up. We are able to accurately classify each one and allow enough time for it. Here again, sometimes more than one Position occurs in succession. We allow time enough for all of them.

Then there's Disengage. This is a rather odd motion and we . . .

Me (interrupting): Is this the kind of stuff you were doing a while ago out in the plant when you were jumping around and waving your arms like an idiot?

I. E. (grinning sheepishly): Yeah, I guess we do look kind of stupid when we are making an Analysis. But it's all pretty necessary. You see, there are so many, many motions in each job that we have to identify and classify and measure. About the only way we can get many of them is to get in there and do them ourselves. Talking with the operator helps a lot, too, because he can often help you to understand the details of the job. But we often get in there and work at least parts of the job, measuring, weighing, reaching, grasping the parts, putting them together, loading the equipment, etc. (Grinning ruefully) Sometimes we get kinda dirty, but we get all the facts.

Me: What were you doing when you were waving your arms around?

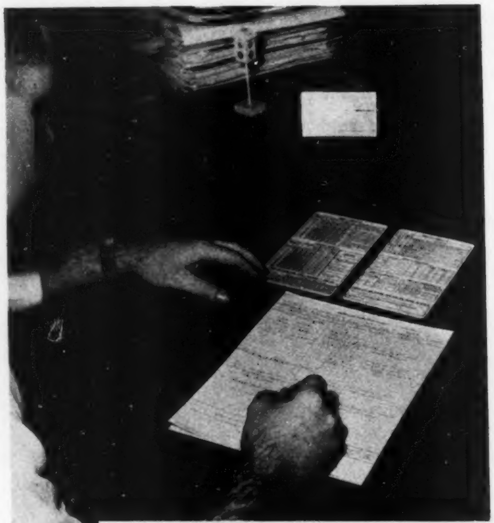
I. E.: I was measuring and also classifying each Reach. You see, the *distance* reached is not enough. I have to classify it, too. It takes longer to reach 12" to a hammer lying loosely on the bench than it takes to reach 12" to a control handle that is always in the same place. It takes longer to reach to a small item than it takes to reach to a large one. When I have classified each Reach, then I can find the proper amount of time to do each one.

Me: How come you put some of those parts together and pulled them apart about a dozen times?

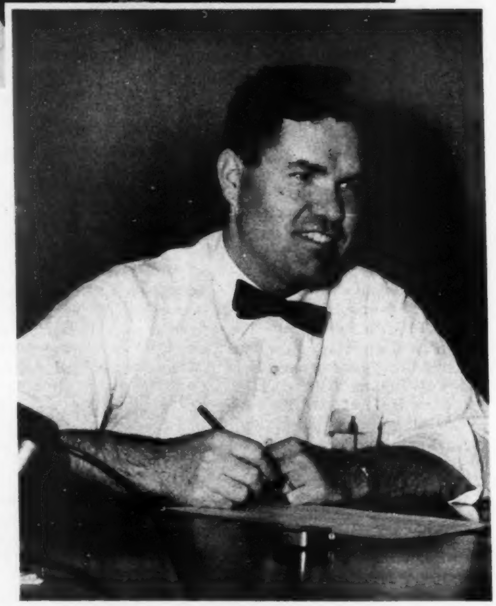
I. E.: I was determining the proper kind of Position. The tightness of fit, the symmetry of the parts, their difficulty of handling, chamfers on the edges, all these things affect the classification and therefore affect the time. The toughest class of Position that can be done with the hands takes nearly 10 times as long as the easiest one.

Me (amazed): Do tell! Is that what you were doing when you were poking parts into that fixture?

I. E.: Yep. That was a pretty easy fit and doesn't take much time. Ordinarily I would call that a P 1 S E. But in this case I noticed that it is a little difficult for him to see in there, so I called it a



Dick Bailey with Data Card works quietly at desk for ... "All you have to do is list all the motions, look on the card to find the time for each one, and add them up."



P 1 S D. That doubled the allowed time for that motion.

Me: Why were you stepping back and forth so much out there?

I. E.: That operation requires the worker to move around a little in his work area. I was imitating his movements to see what I should allow. You see, we give extra time for Sidesteps of 12" or more according to their length and also for each Pace of Walking. In fact, we have times for all body motions like Sitting, Standing, Bending, Stooping, Kneeling, Arising from these positions, Turning the Body, etc.

Me: Why were you stepping on that foot pedal?

I. E.: Same reason. I had to find out if it requires a Foot Motion or a Leg Motion to operate it. Funny thing about that. It actually takes a little longer to depress a pedal using just your foot than it does if you move your whole leg. That's hard to believe, but it's true.

Me: Gee, I guess you guys have a classification for all kinds of motions.

I. E.: That's right, we do. And like I said before, all we have to do is list all the motions that it takes to do the job, look up the time for each one on the Data Card, add up the times, convert them to minutes, add in the allowances, and we have the Production Rate.

Me: Aha! I knew there was something wrong here. Just how do you know that the time figures on that Data Card are correct?

The man at the next desk leaps from his chair and rips handsful of hair from his head: Ye gods, don't ask him that. Now he'll *never* stop talking! And I'm trying to get some work done!

He slumps down again into his chair and bites off a row of fingernails. My Industrial Engineer turns his back upon the pitiful sight and speaks softly.

I. E.: Pay no attention. It's just his ulcers again. Now, you asked about how we know that the Data Card times are accurate. There are many ways we have of knowing.

In the 1st place, these time values were developed after years of motion analysis by some of the finest Industrial Engineers in the country. Much of this work was the careful analysis of thousands of feet of motion picture film of all sorts of industrial operations made both in factories and in laboratories. And boy, were they fussy. For instance, the investigation of the simplest thing we do, Reach, required the timing, charting, and analyzing of over 54,000 pictures.

Me (amazed): All this for just one of the simplest motions?

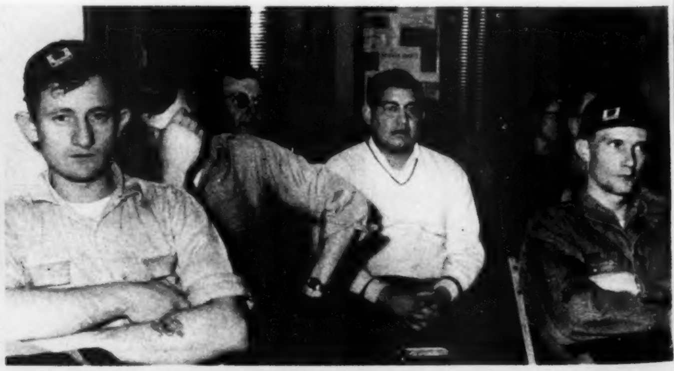
I. E. (waving his arms excitedly): That's right. You can't begin to imagine what those guys went through in analyzing the more complicated motions like all the different Positions. And all the different tiny motions that make up the various cases of Grasp. Why, those people are accuracy nuts! They spent weeks investigating tiny motion details which people like you or I would sluff off as meaning nothing.

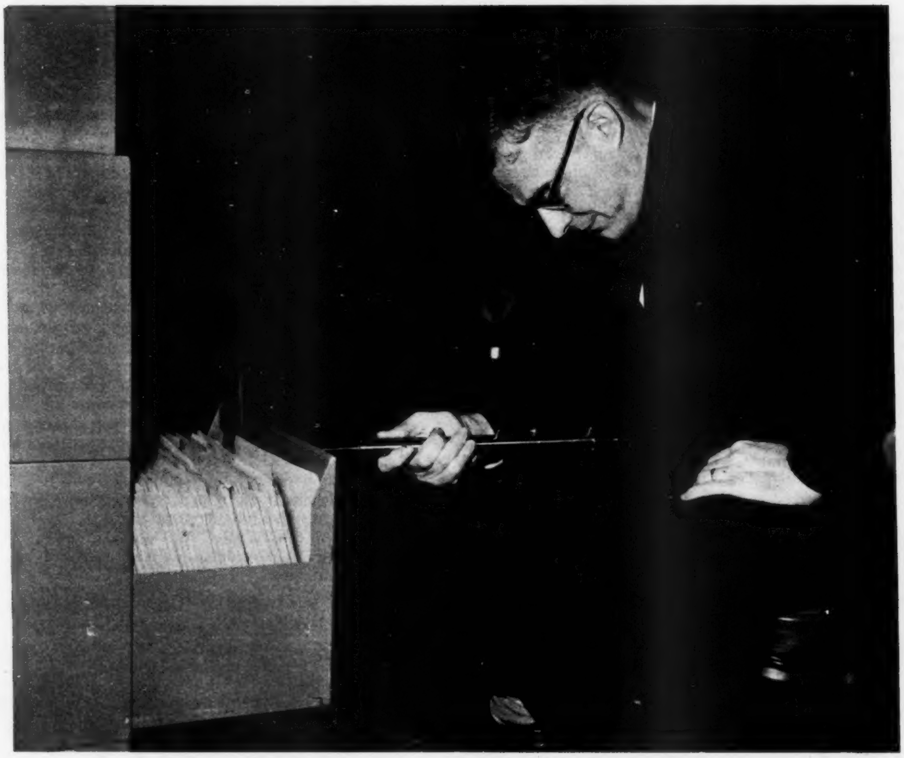
Me (soothingly): Slow down, friend. You're getting ungrammatical.

I. E. (still more excited): Why, they've written whole books containing the research reports showing the accuracy of the times for all these motions. Books, man! Books so detailed with accuracy that they make your head dizzy.

And in the 2nd place, MTM has been applied for years in many, many industries all over America. Rates have been set using MTM on new jobs that had never been timed before. And when the jobs started to run, they found that they were all good rates, neither too tight nor too loose.

And in the 3rd place, the same thing has been done time and again in factories where the rates had already been set. MTM





Gordon Quimby PUSHING with spring scale . . . "First you measure the distance she closes it. Then you push on it with your spring scale to get the weight."

trained people have gone in and analyzed the same jobs that had already been studied. Pow! Right on the button! MTM has been used successfully and fairly in just about every kind of factory operation you can think of from Pipe Fitting to Punch Presses, from Spot Welding to Sewing, from Printing to Packaging. And for lots of office operations, too, like Filing and Operating Accounting Machinery.

Me (acting smarty): Filing? How long does it take a girl to slam a file drawer shut?

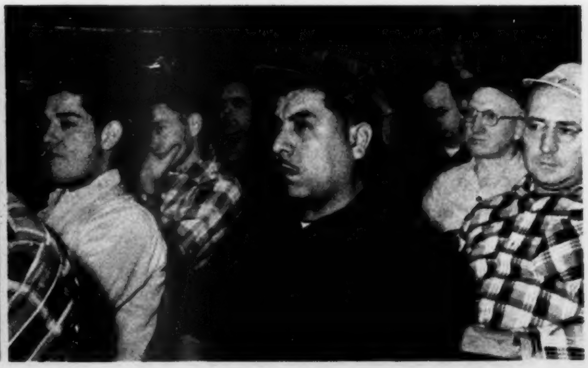
I. E.: Easy. That's a case A Move against a stop. First I'd measure . . .

Me (interrupting): I know, I know. First you measure the distance she closes it. Then you push on it with your spring scale to get the weight. Then you go through all that multiplying and adding mix-mox with your Data Card and come up with the required time. Right?

I. E. (still excited): Right! Spoken like a professional. Now let me finish answering your question about "Is it accurate?"

In the 4th place, MTM has proved its own accuracy in foreign countries, too. It is being used in Sweden, England, France, Holland, Germany, Switzerland, Japan, and other countries. Even the United States Army is using it.

And in the 5th place, *we* tried it out in the *1st* place. Here. At Whirlpool. Over a year ago. We checked a whole slew of our jobs with it and found that it fell right in line with the rates we already had on those jobs. We weren't about to put in anything that didn't fit in and wasn't fair. (Waving his arms excitedly again) Now look, *we've* tried it out, other factories are using it, foreign countries are using it, laboratory tests prove it out, factory tests prove it out, and it was developed from the most painstakingly precise scientific time and motion data available. Its great



accuracy is the very reason we are starting to use it. AND YOU ASK ME, "IS IT ACCURATE?"

Man at the desk (under his breath): I told him he shouldn't ask.

Me (soothingly): Okay, Okay. Calm down, friend. I believe you. You've convinced me. Three or four times you've convinced me. Now, O Learned One, may I ask a little question?

Man at the next desk: Oh, NO!!

I. E.: Pay him no attention. Go ahead, shoot!

Me: What do you do when you are analyzing a clumsy operator?

I. E. (placing his arm paternally around my shoulders): Look, little buddy. Let me pound 1 fact into your pointed little head. We don't analyze the operator with MTM. (shouting): WE ANALYZE THE *METHOD!* THE METHOD, MAN! (softly now, and patiently): We don't care if the man is skilled or if he is just a beginner. We are only interested in the sequence of motions required to do the job. A new man might not be able to do all of them correctly right away, but he'll soon learn. On the other hand, we might find a real hot-shot on a job. We don't write down exactly what he's doing because a normal operator couldn't be expected to do it that same way. We specify a method that a *normal* operator can learn to do.

On some jobs we may find 3 or 4 people all doing the same thing differently. We still specify the best and most economical method that a normal operator can learn. Now, once again. We don't care if the worker is fast or slow, clumsy or skillful. It's METHODS-Time Measurement, not PEOPLE-Time Measurement. Am I getting through to you, boy?

Me: Perfectly. I read you LOUD and clear. Hey, tell me. What do you mean, "normal" operator. (snickering): Can't you work here if you're abnormal?

I. E. (*not* snickering): Very funny. When an Industrial Engineer says "normal" he means about what you mean when you say "average" or "ordinary." We just like to use the term "normal."

Man at the next desk (soft grumble): I don't know why. You sure ain't normal. And I mean *normal* normal.

Me (learning to ignore him): Okay, you've convinced me. When are you going to throw your stopwatch away?

I. E. (looking pleased): I'm not going to, little chum. We still have 3 good uses for a stopwatch. For one thing, you have to use one to check the speed or cycle time of a machine. There's seldom any other way.

Me: So give out with the other two uses, awreddy.

I. E.: Well, as you can see now, MTM is such a painstaking science that it often takes considerably longer to analyze all the motions on a job than it does to simply time it. So you will often see me using a stopwatch to time the stocking portion of a job, you know, like cutting bands, opening cartons, refilling stock pans, chucking the empty boxes, and all that sort of thing. You can imagine what a job it would be to analyze with M T M every twitch and wiggle a man does in performing his stocking operations. Why, each study would be as thick as a book. And besides, because these stocking times are usually a very small percent of the worker's job, it isn't necessary to be so picky. So we take the stock time with a watch.

Me (nodding): Even poor, stupid me can understand that. Now what's the other use?

Man at the desk (muttering): That's what *I* say, "What's the use?"

I. E. (Paying him no heed): There are times around here when a lot of work falls upon us all at once. Like when we start building new models, for example. Everybody wants a thousand rates at once. Now as I said before, MTM often takes longer to do. So-o-o, we will often take a lot of the new studies more rapidly by using a stopwatch and set *temporary* rates on those jobs. Then later, when the crest has passed, we will have the time to come back to those operations and do a first class job of analyzing them with M T M. Then we will set the *permanent* rate, or "Production Standard" as it is supposed to be called.

Me: Tell me, my Academic Analyst, why do you have to set the temporary standard at all? Why don't you just wait until you have time to set the permanent one?

I. E.: Well, we have to have some kind of a goal for our people to work to. But even more important, we have to give these temporary figures to those calculator punching Accountants upstairs. Something to do with Costs and Pricing to our customers and all that. I don't dig it myself, but I do understand that it helps prevent us from going broke and therefore helps to keep all the shop and office workers in this division from feeling the permanent pangs of hunger.

Me (attempting dry humor): That's a *most* convincing reason! Incidentally, is M T M and the Level Pay Plan connected in any way?

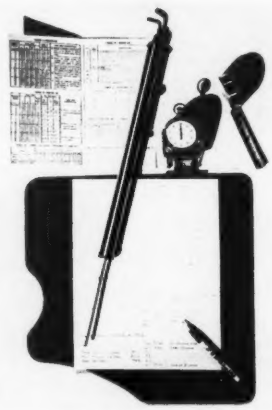
I. E.: Goodness, no! We've been introducing MTM around here for over a year. The Level Pay Plan is something brand new. But I suppose you might say that there *is* a connection in one important way. As you know, the Level Pay Plan is based upon Fairness. Now that you know how accurate MTM is, and that the Production Standard is based upon the method instead of upon the worker, you can see that *its* keynote is Fairness, too. So I guess there *is* a connection in that way. Fairness.

Me (standing up and moving toward the door): Well, thanks a lot for your explanation. Boy, this MTM is *some* stuff!

I. E. (leaning back in his chair): I think the operators like it, too. Sometimes you feel a little uncomfortable when someone is standing beside you timing everything you do. It's much more pleasant to discuss the job with the Industrial Engineer and help him to understand the operation so that he can analyze it thoroughly. You see, once we've seen the job run enough to know what it consists of, we don't give a whoop whether anybody is running it or not. We often go back to it during lunch or break time or after the shift is done in order to get some of the measurements and details.

Me (sneezing violently as I go out the door): Looks like MTM allows time for the operator to do everything but sneeze.

I. E.: Oh, we give time for that, too.
It's in the Standard Allowances.
Under "Unavoidable Delays."
Gesundheit!



Tools of the fairest work measurement method yet known to man — MTM
"We still use a stopwatch for . . . the cycle time of a machine . . . refilling stock . . . and to . . . more rapidly . . . set temporary rates . . ."

APPLICATION I

THE APPLICATION OF METHODS-TIME-MEASUREMENT TO THE STOCK CONTROL FUNCTION

by

1/Lt. Jacques E. Linder
Systems Engineer
Air Materiel Command
U. S. A. F.

I. INTRODUCTION

The Methods-Time-Measurement, or MTM, technique is a new and widely used tool of the industrial engineer in private industry. As the techniques of industrial engineering were applied to the United States Air Force's Air Materiel Command Operations in the early and mid 1950's, it was only natural to provide the Command with personnel trained in this new technique.

Its use so far has been quite limited in scope. It has been used in some isolated cases in the Directorate of Maintenance's Work Measurement Program. Then, in the Grass Roots Improvement Program of the Directorate of Supply & Services which followed, it has been used more sparingly, due to the relatively few number of qualified personnel capable of using MTM.

During the initial stages of implementation of the Grass Roots Improvement Program in the Directorate of Supply & Services, Headquarters, Northern Air Materiel Area, Europe, at Burtonwood RAF Station, England, a full-scale MTM Application Training Course was held for all the Work Measurement Technicians assigned to the Industrial Engineering Division. Upon completion of this course, along with a comprehensive course in other work measurement techniques, these men were given the job of setting engineered time standards throughout the Supply operation using whatever technique they felt to be the best for the particular problem, whether it be time study, engineered work sampling, MTM, standard data, etc.

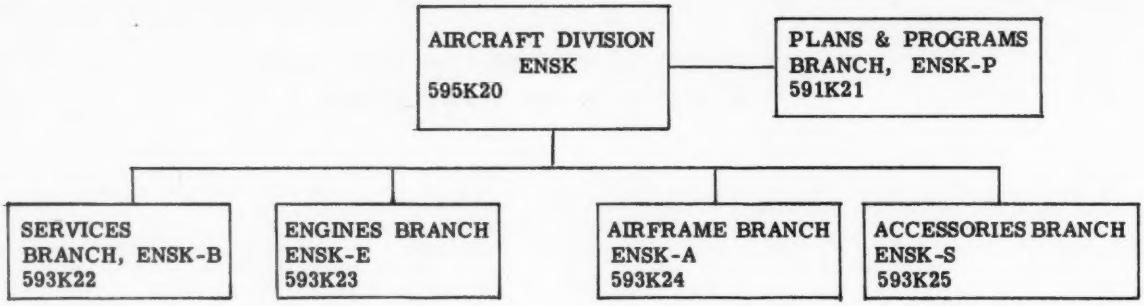
In one instance, the Work Measurement technicians decided to implement a complete work center with MTM, with the result that 95% of the standards determined were made with this technique. The organization to which they were assigned was the Aircraft Division, one of the five so-called "Commodity Divisions" which were responsible for the property accounting function within Supply. The operations they were analyzing were predominantly of a clerical nature, with the handling and processing of paperwork the basic function of the organization.

Since this type of operation is relatively difficult to analyze using the MTM technique, the author has felt that these studies compiled from those made by M/Sgt Edward L. Case, AF 37086225, and T/Sgt Robert K. Cave, AF 13136072, are worthy of the detail described below. It is hoped that the following studies will show how the MTM technique can be used to good advantage even in a difficult to analyze operation such as that of the Aircraft Division. It will also be shown how the MTM analysis completely describes the job performed, without the vague elemental descriptions that accompany a standard set by conventional time study. With the operation described so completely, the basis is laid for a comprehensive set of standard data for any particular operation throughout the Air Materiel Command's system of Air Materiel Areas and Air Force Depots. Using this MTM nomenclature, a set of data can be gathered at any location, then interpreted and compiled at a central location with consistency and understanding.

The methods that the following studies describe are not necessarily the most economical that could be made. These studies were made on the operations as they existed in the Aircraft Division during the months of May through August 1957. Since the purpose of this description is only to show the techniques of MTM used in setting engineered time standards, the savings that could be accomplished by subjecting the operations to a thorough methods analysis will not be discussed here.

Before describing the operations of the Division, its organization should be charted as follows:

APPLICATION I



The Services Branch acts as a central distribution agency for the other branches within the division. The other three branches perform the property accounting function, with each branch responsible for a prescribed set of stock items. Since each of these three branches performs the same jobs, the studies given below will be made on the basis of what happens to the document as it is processed through Services Branch, and as it is processed through one of the property accounting branches, which, for the studies, will be the Engines Branch.

Each MTM study to follow will be discussed in complete detail. Since each study is only a part of each element of the standard, a discussion of the occurrence factor involved in each case will be given after the study. Then, the relationship of the element to the work unit as a whole will be discussed, and finally, a flow diagram will be given of each work unit over the floor plan of the Aircraft Division, showing where each element is accomplished. It is hoped that this type of analysis can provide a complete description of the job involved, and that the complete operation can be reconstructed by the reader if he possesses a comprehensive knowledge of the MTM system.

The nomenclature used in this study is as follows: A "Work Unit" is the complete job, as shown on the AMC Form 178E's, pages 26a, 46a, 48a, & 116a. Each work unit consists of "elements", which are numbered throughout this study. Then, each element is made up of "sub-elements", which are identified by means of a letter. A complete MTM study is found at the "sub-element" level, and a particular study is identified in the following manner: "Element 4-D, Work Unit 002-0, Services Branch, page 73."

II CONCLUSIONS

a. The MTM technique can be used with good results to determine standards across the broad range of paperwork operations to be found within the Stock Control function. In the organization described in this study, 95% of the standards determined were made with MTM.

b. The MTM time values compare very favorably with time study values for similar elements, with the two values usually within 3% of one another.

c. MTM provides an excellent means for standard data usage, due to the minuteness of its analysis. MTM studies can be interchanged freely within elements where a similar job occurs, because the content of the MTM study is known in detail. In fact, as more and more work units are completed, more and more opportunities arise for utilizing previous studies made. Many, many motion patterns become standard with the analyst, and become standard building blocks in his construction of standards.

d. MTM can provide a universal language to describe jobs throughout a geographically diverse command such as AMC. Without such a language, descriptions of jobs will be vague and undecipherable with respect to similar jobs at other installations. With a means of comparison, such as MTM, a consistent "best way" to do the jobs which involve the greatest part of the AMC workload can be determined and applied with consistency and accuracy by trained MTM personnel at any location.

III PROCESSING DEBIT DOCUMENTS

This work unit describes the processing of documents that list material received into Supply and which cause the current balance of that particular item to rise. The flow of this type of document can be seen in Charts #1 and 2 on pages 38 and 39. The document is received

from the Receiving function, then sent through the Services Branch for the preparation of a transaction card, the clipping the card to the document, and distribution to the appropriate branch. The property accounting branch, for example, the Engines Branch, then distributes the document to the appropriate cell clerk, who then posts the transaction to the balance card and puts the completed document in the out basket.

The MTM analysis for this operation through Services Branch is as follows:

<u>WORK UNIT # 001-0</u>   <u>SERVICES BRANCH</u>

<u>PROCESSING DEBIT VOUCHERS</u>

1. <u>PREPARE TRANSACTION AND CONTROL CARDS</u>

BASIS: Line Item (one L/I per document)

A. <u>Pick up Documents</u>

Left Hand	No.	L. H.	TMU	R. H.	No.	Right Hand
			43.4	STD		Arise from chair
			34.1	SSC2		Side step from behind chair
			18.6	TBC1		Turn to walk away
			75.0	W5P		Walk to desk
				~~R24B~~		Reach to document
			2.0	G1A		Grasp bunch of documents
			11.2	G2	2	Regrasps
			37.2	TBC2		Turn about
			75.0	W5P		Return to seat
				~~M12B~~		Move to desk
			2.0	RL1		Release documents
			34.1	SSC2		Sidestep behind chair
			34.7	SIT		Sit down

TOTAL   367.3 TMU

An average of two hundred documents are picked up at a time. Occurrence Factor $= \frac{1}{200} = .005$

B. <u>Remove Rubber Band</u>

Left Hand	No.	L. H.	TMU	R. H.	No.	Right Hand
Reach to Area		R15E	15.1	R15B		Reach to bunch of documents
			2.0	G1A		Grasp bunch
			15.2	M15B		Move toward left hand
Grasp Rubber band		G1B	3.5			
Pull off band and to desk		M15B	15.2			
Release band		RL1	2.0			
			10.6	M8B		Move to desk
			2.0	RL1		Release bunch

TOTAL   65.6 TMU

Twenty-five documents were contained in the average bunch. Occurrence Factor = 1/25 = .04.

C. Punch Transaction card & Control Card

STOPWATCH = 322.0 TMU

Each line item requires this element. Occurrence Factor = 1.00

D. Change Cylinder Card

STOPWATCH = 417.0 TMU

The cylinder card is changed for each 25 L/I processed. Occurrence Factor = 1/25 = .04

E. Remove Old Cards & Replace

STOPWATCH = 284.0 TMU

Old cards are removed and replaced once for each 25 L/I. Occurrence Factor = 1/25 = .04

F. Bunch Documents & Band together

STOPWATCH = 500.0 TMU

25 cards are bunched together on the average. Occurrence Factor = 1/25 = .04

The above elements were found to be more easily timed by means of the stopwatch, due to the complexity of the finger motions involved.

G. Aside to Out-Box

Left Hand	No.	L. H.	TMU	R. H.	No.	Right Hand
			0.0	G5		Contact Grasp Documents
			6.0	RfB	3	Reach under documents
			2.0	G1A		Grasp documents
			12.8	M11B		Move to Out-Box
			2.0	RL1		Release
			11.2	R11E		Return to area
TOTAL			34.0 TMU			

The bunches are put aside one by one with 25 documents per bunch. Occurrence Factor = 1/25 = .04

H. Move to Clipping Clerk

			15.1	R15B		Reach to stack of finished cards
			2.0	G1A		Grasp
			11.2	G2	2	Regrasp
			43.4	STD		Arise
			34.1	SSC2		Sidestep from behind chair
			18.6	TBC1		Turn to walk away
			180.0	W12P		Walk to Clipping Clerk desk
				~~M15B~~		Move documents to desk
			2.0	RL1		Release documents
			37.2	TBC2		Turn about

Left Hand	No.	L. H.	TMU	R. H.	No.	Right Hand
			180.0	W12P		Return to machine
			34.1	SSC2		Sidestep behind chair
			34.7	SIT		Sit down
TOTAL			592.4 TMU			

The bunches are taken to the pinning clerk with approximately 200 documents per trip. Occurrence Factor = 1/200 = .005

SUMMARY - PREPARE TRANSACTION AND CONTROL CARDS

Element	Time	Occurrence	Time Allowed
A. Pick up Documents	367.3	.005	1.8
B. Remove Rubber Band	65.6	.04	2.6
C. Punch Transaction & Control Card	322.0	1.00	322.0
D. Change Cylinder Card	417.0	.04	16.7
E. Remove Old Cards & Replace	284.0	.04	11.4
F. Bunch Document & Band together	500.0	.04	20.0
G. Aside to Out-Box	34.0	.04	1.4
H. Move to Pinning Clerk	592.4	.005	3.0
			378.9 TMU
			= .227 min. per L/I

Reviewing this first element, the reader may notice how completely the MTM studies bring out the details of the operation when compared to a time study. The time study seems to leave the reader up in the air as to exactly how the operation was done. For example, sub-element F, "Bunch Documents& Band Together" could be done in any number of ways. However, looking at Element G, "Aside to Out-Box", we know exactly how the operation was performed, where the out-box was with respect to the operator, and exactly what manipulations the operator made with her hands to get the documents. With this information, we perhaps can rearrange her workplace to facilitate these hand manipulations, or bring everything closer to her, etc. However, we cannot make these improvements until we know exactly how she was doing it originally. MTM can provide the basis for recording these minute, yet necessary parts of the operation.

2. CLIPPING AND SORTING FOR DELIVERY

BASIS: Line Item (one L/I per document)

A. Remove Rubber Band from Bunch

Left Hand	No.	L. H.	TMU	R. H.	No.	Right Hand
			15.8	R16B		Reach for bunch of documents
			2.0	G1A		Grasp bunch
Reach to bunch		R10B	14.6	M14B		Move to center of desk
Grasp with left hand		G3	5.6	G3		Transfer to left hand
			6.4	R4B		Reach to rubber band
			3.5	G1B		Grasp band

Left Hand	No.	L. H.	TMU	R. H.	No.	Right Hand
			8.9	M6B		Pull off rubber band
Move bunch to desk		M4B	13.4	M12B		Move to rubber band box
			2.0	RL1		Release
TOTAL			72.2 TMU			

Each bunch contains approximately 25 document. Occurrence Factor = 1/25 = .04

B. Move Documents to Area

Regrasp transaction cards		G2	5.6			
Move off documents to desk		M6B	8.9			
Release on desk		RL1	2.0			
TOTAL			16.5 TMU			

The documents are moved to the area by bunches, with 25 documents per bunch. Occurrence Factor = 1/25 = .04

C. Move Control Cards to Documents and Compare

Reach to pile of documents		R8B	10.1	R8B		Reach to pile of cards
Grasp documents		G1A	3.5	G1B		Grasp Control Cards
Move document		M2B	10.6	M8B		Move card to document
			43.8	EF	6	Compare 14 digit number
			14.6	EF	2	Compare amount
TOTAL			82.6 TMU			

Each control card is compared to its accompanying document. Occurrence Factor = 1.00

D. Clip Transaction Card & Aside Control Card

			10.6	M8B		Move control card to pile
			2.0	RL1		Release card
			6.4	R4B		Reach to transaction card
			3.5	G1B		Grasp Card
			10.6	M8B		Move to document
Grasp transaction card		G3	5.6	G3		To left hand
Regrasp		G2	12.9	R10C		Reach to paper clip
			9.1	G4B		Grasp Clip
			13.5	M10C		Move to document
				~~G2~~		Regrasp on way
			5.6	G2		Regrasp clip
			16.2	AP1		Push long end of clip on card to open
			2.9	M1B		Move clip on
TOTAL			110.7 TMU			

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The transaction card is clipped on each document. Occurrence Factor = 1.00

E. Band Control Cards

Left Hand	No.	L. H.	TMU	R. H.	No.	Right Hand
Reach for cards		R12B	12.9	R8B		Reach for cards
Contact grasp		G5	0.0	G5		Contact grasp
Reach under cards	4	RfB	8.0	RfB	4	Reach under cards
Regrasp	2	G2	11.2	G2	2	Regrasp
Move up from desk		M4B	6.9	RL1		Release deck
			11.5	R8C		Reach for rubber band
			9.1	G4B		Grasp Band
		G2	12.9	M12A		Band to other hand hooking around finger
		RfB		~~G2~~		Regrasp band to open it
		G5				
Hold band tightly		AP2	10.6	M8B		Move band around documents
				~~G2~~		Open band with fingers
			4.0	R2A		Close fingers releasing
			2.5	R1B		Reach to right end of cards
To right hand		G3	5.6	G3		Transfer Grasp
			15.2	M15B		Move to desk
			2.0	RL1		Release
TOTAL			112.4 TMU			

The cards are banded with approximately 10 per bunch. Occurrence Factor = 1/10 = .10

F. Pick up Batch & Move to Distribution Desk

Left Hand	No.	L. H.	TMU	R. H.	No.	Right Hand
Reach to pile of documents		R15B	15.1	R15B		Reach to documents
Contact grasp		G5	0.0	G5		Contact Grasp
Reach under documents	3	RfB	6.0	RfB	3	Reach under documents
Grasp documents		G1A	2.0	RL2		Release
Regrasp documents		G2	5.6			
			43.4	STD		Arise from chair
			34.1	SSC2		Sidestep from chair
			18.6	TBC1		Turn about
			60.0	W4P		Walk to distribution desk
			34.1	SSC2		Sidestep behind chair
Move documents to desk		M15B	34.7	SIT		Sit down
Regrasp to group		G2	5.6			
Place on desk		M5B	8.0			
Release		RL1	2.0			
TOTAL			269.2 TMU			

The documents are carried to the distribution desk in bunches of approximately 50. Occurrence Factor = 1/50 = .02

G. Sort to Out-Box

Left Hand	No.	L. H.	TMU	R. H.	No.	Right Hand
			12.9	R12B		Reach for document
			3.5	G1B		Grasp document
			7.3	EF		Check class
			13.4	M12B		Move to out box
			2.0	RL1		Release
TOTAL			29.1	TMU		

Each document is sorted. Occurrence Factor = 1.00

H. Return to Desk

Left Hand	No.	L. H.	TMU	R. H.	No.	Right Hand
			43.4	STD		Stand up
			34.1	SSC2		Sidestep from chair
			18.6	TBC1		Turn about
			60.0	W4P		Walk to clipping desk
			34.1	SSC2		Sidestep behind chair
			34.7	SIT		Sit down
TOTAL			224.9	TMU		

A trip to the distribution desk is made, on the average, once every 50 documents. Occurrence Factor = 1/50 = .02

When errors are discovered in the control card (which is identical to the transaction card), the following procedure, (Element I), is needed between operations C & D in addition to those described above. After elements I & J, the operator starts on the next document (Element C).

I. Underline

Left Hand	No.	L. H.	TMU	R. H.	No.	Right Hand
			2.0	RL1		Release card on document
			17.2	R18B		Reach for pencil on desk
			3.5	G1B		Grasp pencil
			5.6	G2		Regrasp
			20.4	M18C		Move to control card
			5.6	P1SE		Position point under error
			5.7	M3B		Draw line
			17.0	M18B		Move pencil to desk
			2.0	RL1		Release pencil
			15.8	R16B		Reach to second transaction card
			3.5	G1B		Grasp card
			10.6	M8B		Move card to document
Regrasp cards and document		G2	5.6	RL1		Release
TOTAL			114.5	TMU		

J. Move to 0.26 Machine

Left Hand	No.	L. H.	TMU	R. H.	No.	Right Hand
Move up		M15B	43.4	STD		Arise
			34.1	SSC2		Sidestep from chair
			18.6	TBC1		Turn about
Move to desk		M10B	180.0	W12P		Walk to 026 operator
Release document		RL1	2.0			
			37.2	TBC2		Turn about
			180.0	W12P		Walk back to desk
			34.1	SSC2		Sidestep behind chair
			34.7	SIT		Sit down

TOTAL 564.1 TMU

An error in the transaction card occurs once in every 200 documents, so the occurrence factor for elements I & J is 1/200, or .005.

SUMMARY - CLIPPING AND SORTING FOR DELIVERY

Element	Time	Occurrence	Time Allowed
A. Remove Rubber Band from Bunch	72.2	.04	2.9
B. Move Documents to Area	16.5	.04	.6
C. Move Control Cards to Documents & Compare	82.6	1.00	82.6
D. Clip Transaction Card & Aside Control Card	104.2	1.00	110.7
E. Band Control Cards	112.4	.10	11.2
F. Pick up Batch & Move to Distribution Desk	269.2	.02	5.4
G. Sort to Out-Box	39.1	1.00	39.1
H. Return To Desk	224.9	.02	4.5
I. Underline	114.5	.005	.6
J. Move to 026 Machine	564.1	.005	2.8

260.4 TMU
= .156 min. per line item

3. DISTRIBUTION TO BRANCHES — BASIS: One Trip

A. Transport Boxes to Delivery Point

Left Hand	No.	L. H.	TMU	R. H.	No.	Right Hand
			43.4	STD		Arise from chair
Crook Arm		R1CE	86.0	R18B	5	Reach to box
			10.0	G1A	5	Grasp box
			85.0	M18B	5	Move box to arm
			8.0	RL1	4	Release
			34.1	SSC2		Sidestep

Left Hand	No.	L. H.	TMU	R. H.	No.	Right Hand
			18.6	TBC1		Turn about
			1545.0	W103P		Walk to delivery points & return

TOTAL 1830.1 TMU

The boxes are picked up and delivered once per trip. Occurrence Factor = 1.00

B. Deliver Incoming Documents and Take Outgoing Documents

Left Hand	No.	L. H.	TMU	R. H.	No.	Right Hand
			5.6	G2		Regrasp boxes
			14.6	M14B		Move to desk
			2.0	RL1		Release
Reach for box		R8B	11.5	R10B		Reach for papers
Grasp box		G1A	2.0	G1A		Grasp papers
			5.6	G2		Regrasp papers
			13.4	M12B		Move to in-box of branch
			2.0	RL1		Release
Move box to desk		M8B	10.6			
Release box		RL1	2.0			
			11.5	R10B		Reach to branch out-basket
			0.0	G5		Contact Grasp
			6.0	RfB	3	Reach under documents
			2.0	G1A		Grasp documents
			12.2	M10B		Move documents to tote-box
			2.0	RL1		Release

TOTAL 103.0 TMU

There are five distribution points throughout the trip, with one box for each. The papers in each carried box are placed in the in-box and documents taken from the out-box at each stop. Occurrence Factor = 5.00

C. Restack Boxes

Reach for boxes		R8B	10.1	R8B		Reach for boxes
Grasp boxes		G1A	2.0	G1A		Grasp boxes
Move on top of empty box		M8B	10.6	M8B		Move on top of empty box
Release		RL1	2.0	RL1		Release
Reach to bottom of stack		R4B	6.4	R4B		Reach to bottom of stack
Grasp		G1A	2.0	G1A		Grasp
Regrasp		G2	5.6	G2		Regrasp
Move up		M14B	14.6	M14B		Move up

TOTAL 53.3 TMU

The boxes are restacked at each distribution point. Occurrence Factor = 5.00

D. Replace Empty Boxes on Desk

Left Hand	No.	L. H.	TMU	R. H.	No.	Right Hand
Move empty boxes to desk		M15B	15.2	M15B		Move empty boxes to desk
Release		RL1	2.0	RL1		Release
			72.0	R14B	5	Reach for box
			10.0	G1A	5	Grasp
			73.0	M14B	5	Move box to place on desk
			10.0	RL1	5	Release
			34.1	SSC2		Sidestep
			34.7	SIT		Sit down
TOTAL			251.0 TMU			

The boxes are repaced on the desk once per trip. Occurrence Factor - 1.00

SUMMARY - DISTRIBUTION TO BRANCHES

Element	Time	Occurrence	Time Allowed
A. Transport Boxes to Delivery Points	1830.1	1.00	1830.1
B. Deliver Incoming Documents & Take Out-Going Documents	103.0	5.00	515.0
C. Restack boxes	53.3	5.00	266.5
D. Replace Empty Boxes on Desk	251.0	1.00	251.0
			2862.6 TMU
			= 1.718 min. per trip

4. DISTRIBUTION TO IAM AND VOUCHER CONTROL BASIS: One Line Item Processed (Debit or Credit)

After the credit and debit documents have been posted to the balance card in the property accounting branches, they are sorted in the Services Branch to segregate the credits resulting in shipments which will be subsequently sent to the warehouse. This element starts at the distribution desk in Services Branch as shown on the flow diagram, Page 39, with the documents in the baskets on the desk.

A. Reach to Documents

Left Hand	No.	L. H.	TMU	R. H.	No.	Right Hand
			20.1	R22B		Reach for handful of documents
This motion pattern can be done with either hand.			0.0	G5		Contact Grasp
			6.0	RfB	3	Reach under documents
			2.0	G1A		Grasp documents
			18.2	M20B		Move to desk
			2.0	RL1		Release
TOTAL			48.3 TMU			

On the average, 25 documents are picked up and moved to the desk at a time. Occurrence Factor = 1/25 = .04

B. Sort Documents to Segregate

Left Hand	No.	L. H.	TMU	R. H.	No.	Right Hand
			11.5	R10B		Reach to individual documents
This motion pattern			3.5	G1B		Grasp documents
can be done with			7.3	EF		Determine document action
either hand			12.2	M10B		Move to correct pile
			2.0	RL1		Release document
TOTAL			36.5 TMU			

Each debit document is sorted. Occurrence Factor = 1.00

C. Pick up Voucher Control Cards

			43.4	STD		Arise from chair
				~~R29B~~		Reach for empty tray
			2.0	G1A		Grasp tray
			34.1	SSG2		Sidestep from chair
				~~M29B~~		Bring tray to carrying position
			18.6	TBC1		Turn body
Reach for cards		R10B	225.0	W15P		Walk to first distribution desk
				~~C2~~		Regrasp tray
Grasp cards		G1A	2.0			
Move cards to tray		M10B	12.2			
Release in tray		RL1	18.6	TBC1		Turn body
Reach for cards		R10B	150.0	W10P		Walk to second desk
				~~C2~~		Regrasp Tray
Grasp cards		G1A	2.0			
Move cards to tray		M10B	12.2			
Release cards in tray		RL1	18.6	TBC1		Turn about
Hand aside		R20E	375.0	W25P		Return to desk
				~~M15B~~		Move tray to desk
			2.0	RL1		Release tray
TOTAL			915.7 TMU			

The voucher control copies are picked up once for each trip to IAM. Since the trip is made carrying 1500 processed documents, the Occurrence Factor = 1/1500 = .0007.

D. Pick up Remaining Documents Throughout Division

			11.5	R10B		Reach for empty tray
			2.0	G1A		Grasp tray
			18.6	TBC1		Turn about

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Left Hand	No.	L. H.	TMU	R. H.	No.	Right Hand
				~~M10B~~		Bring tray to carrying position
Reach for documents		R10B	675.0	W45P		Walk to Airframe Branch Distribution Desk
				~~G2~~		Regrasp tray
Contact grasp documents		G5	0.0			
Reach under document	3	RfB	6.0			
Grasp documents		G1A	2.0			
Move to tray		M10B	12.2			
Release in tray		RL1	18.6	TBC1		Turn body
Hand aside		R20E	300.0	W20P		Walk to Accessories Branch distribution desk
Reach for documents		R10B				
				~~G2~~		Regrasp tray
Contact grasp documents		G5	0.0			
Reach under documents	3	RfB	6.0			
Grasp documents		G1A	2.0			
Move to tray		M10B	12.2			
Release in tray		RL1	18.6	TBC1		Turn body
Hand aside		R20E	150.0	W10P		Walk to Engines branch distribution desk
Reach for documents		R10B				
				~~G2~~		Regrasp tray
Contact grasp documents		G5	0.0			
Reach under documents	3	RfB	6.0			
Grasp documents		G1A	2.0			
Move to tray		M10B	12.2			
Release in tray		RL1	34.1	SSC2		Sidestep to second out-basket
Reach for documents		R10B				
Contact Grasp		G5	0.0			
Reach under documents	3	RfB	6.0			
Grasp documents		G1A	2.0			
Move to tray		M10B	12.2			
Release in tray		RL1	34.1	SSC2		Sidestep to third out-basket
Reach for documents		R10B				
Contact grasp		G5	0.0			
Reach under documents	3	RfB	6.0			
Grasp documents		G1A	2.0			
Move to tray		M10B	12.2			

Left Hand	No.	L. H.	TMU	R. H.	No.	Right Hand
Release in tray		RL1	18.6	TBC1		Turn body
Hand aside		R20E	450.0	W30P		Return to Services Branch
				~~M10B~~		Move tray to desk
			2.0	RL1		Release tray
			34.1	SSC2		Sidestep behind chair
			34.7	SIT		Sit down

TOTAL 1902.9 TMU

This trip to pick up remaining documents throughout the division is made once before the trip to IAM and Voucher Control. Since each trip is made carrying 1500 processed documents, the Occurrence Factor = 1/1500 = .0007.

The remaining documents picked up in the previous element are now sorted in accordance with Elements A & B.

E. Deliver Documents to IAM and Voucher Control

			43.4	STD		Stand up
			186.0	R20B	10	Reach for handful of sorted documents
			0.0	G5	10	Contact grasp
			40.0	RfB	20	Reach under documents
			20.0	G1A	10	Grasp documents
			182.0	M20B	10	Move to empty tray
			20.0	RL1	10	Release
Reach for tray of control cards		R15B	15.8	R4B		Reach for tray of documents
Grasp tray		G1A	2.0	G1A		Grasp tray
Tray to carrying position		M15B	34.1	SSC2		Sidestep from chair
				~~M15B~~		Tray to carrying position
			18.6	TBC1		Turn body
Regrasp tray		G2	750.0	W50P		Walk to Voucher Control
				~~G2~~		Regrasp tray
			12.2	M10B		Move tray to other arm
			2.0	RL1		Release on top of tray of cards
			6.4	R4B		Reach for first handful of documents
			0.0	G5		Contact grasp
			4.0	RfB	2	Reach under documents
			2.0	G1A		Grasp documents
			18.2	M20B		Move documents to Voucher Control in-box
			2.0	RL1		Release

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Left Hand	No.	L. H.	TMU	R. H.	No.	Right Hand
			167.4	R20B	9	Reach for handful of documents
			0.0	G5	9	Contact grasp
			36.0	RfB	18	Reach under documents
			18.0	G1A	9	Grasp documents
			163.8	M20B	9	Move to in-box
			18.0	RL1	9	Release
			18.6	TBC1		Turn body
				~~B20E~~		Hand aside
Regrasp trays		G2	450.0	W30P		Walk to IAM
				~~R15B~~		Reach to top tray in other hand
				~~G1A~~		Grasp
				~~M10B~~		Move off and carry
				~~M10B~~		Move tray to desk in IAM
Move tray on top of empty tray on desk		M20B	18.2			
Release		RL1	2.0			
Reach for cards		R4B	8.6	R6B		Reach for stack of cards
Grasp		G1A	2.0	G1A		Grasp
Move to IAM In-box		M10B	12.2	M10B		Move to IAM In-Box
Release		RL1	2.0	RL1		Release
			11.5	R10B		Reach to empty trays
			2.0	G1A		Grasp
			18.6	TBC1		Turn body
				~~M10B~~		Move trays to carrying position
			1200.0	W80P		Return to Services Branch
				~~M15B~~		Move trays to desk
			2.0	RL1		Release trays
			34.1	SSC2		Sidestep behind chair
			34.7	SIT		Sit down
TOTAL			3578.4 TMU			

This trip is made with approximately 1500 processed documents. Occurrence Factor = 1/1500 = .0007

APPLICATION I

SUMMARY - DISTRIBUTION TO IAM AND VOUCHER CONTROL

Element	Time	Occurrence	Time Allowed
A. Reach to Documents	48.3	.04	1.9
B. Sort Documents to Segregate	36.5	1.00	36.5
C. Pick up Voucher Control Cards	915.7	.007	.6
D. Pick up Remaining Documents throughout Division	1902.9	.0007	1.3
E. Deliver documents to IAM & Voucher Control	3578.4	.0007	2.5
		TOTAL	42.8 TMU
		= .026 min. per line item	

Using the above figures, the standard shown on the following page was made. Since elements 1, 2 & 4 were made on the basis of line item, their Occurrence Factor is 1.00 as the unit of count is line item. However, element 3 was made on the basis on one trip. Since 300 documents on the average are carried per trip, the occurrence factor for the standard is 1/300 or .003.

After processing through the Services Branch, the debit voucher goes into the appropriate property accounting branch and the following work unit is accomplished:

TIME STANDARD ELEMENTS SUMMARY HQ. NAMAE, BURTONWOOD, ENGLAND

WORK CENTER				WORK UNIT			CURRENT PRODUCTION STANDARD						ORIGINAL PRODUCTION STANDARD					NORMAL IN PROCESS			ADDITIONAL CARD PUNCH DATA
FUNCTION	DIVISION	WORK CEN	SUB W/C	UNIT	SUFFIX	PROCESS CODE	STANDARD	TYPE	REVISED DATE MO.	REVISED DATE YR	REASON CODE	ANALYST CODE	STANDARD	TYPE	ESTABLISHED DATE MO.	ESTABLISHED DATE YR	ANALYST CODE	EARNED HOURS	DATE ESTB MO.	DATE ESTB YR	
1 2 3	4	5	6	7 8 9	10	11 12	13 14 15 16 17	18 19	20 21	22	23 24	25 26	27 28 29 30 31	32 33	34 35	36	37 38	39 40 41 42 43	44 45	46	
5 9 3	F	2	2	0 0 1	0	0 0	0 0 0 1 0	4 0	0 8	7	1 0	0 9	0 0 0 1 0	4 0	0 8	7	0 9				

NO.	ELEMENT DESCRIPTION AND REFERENCES		NORMAL	% OCC	BASE
GD	Includes all manhours expended in the preparation of the transaction cards, clipping, sorting, and distribution of all debit documents.				
1.	Prepare transaction and control cards	(30)	.227	1.00	.227
2.	Clipping & sorting for delivery	(40)	.156	1.00	.156
3.	Distribution to branches	(40)	1.718	.003	.006
4.	Distribution to IAM & Voucher Control	(40)	.026	1.00	.026
5.	Interference & coordination (25%)	(60)			.104
	NOTE: Any deviation from standard procedure will render standard invalid & must be reported to work measurement analyst immediately.				

APPROVAL	DATE	APPROVAL	DATE	TOTAL	.519
				PR and D	.078
REVIEW	DATE	REVIEW	DATE	STAN MINUTES	.597
				STAN HOURS	.010

COUNT CATEGORY I

TITLE
Processing Debit Documents

COUNT PROCEDURE AND CONTROLS
Unit of Count: Line Item

In Count: Taken manually by the production counter at 026 operator in-basket.

Out Count: Total of incounts for work unit 001-0 for Engines, Accessories & Airframe Branches.

LIST BELOW ALL WORK UNITS WHICH HAVE BEEN MADE OBSOLETE AND THE INCREMENTAL CHANGES IN THE CORRESPONDING STANDARDS

WORK CENTER	WORK UNIT	PROCESS	TIME VALUE

REMARKS P.R. & D. Breakout

Personal	6%	Safety	0%
Condition	0%	Work Sta	3%
Position	1%	Coord	1%
Monotony	1%	Mental	2%
		Fatigue	1%
		TOTAL	15%

.010 = 100 L/I/Hr.

AMC FORM 14 NOV 56 178E PREVIOUS EDITION OF THIS FORM ARE OBSOLETE.

CHART 1

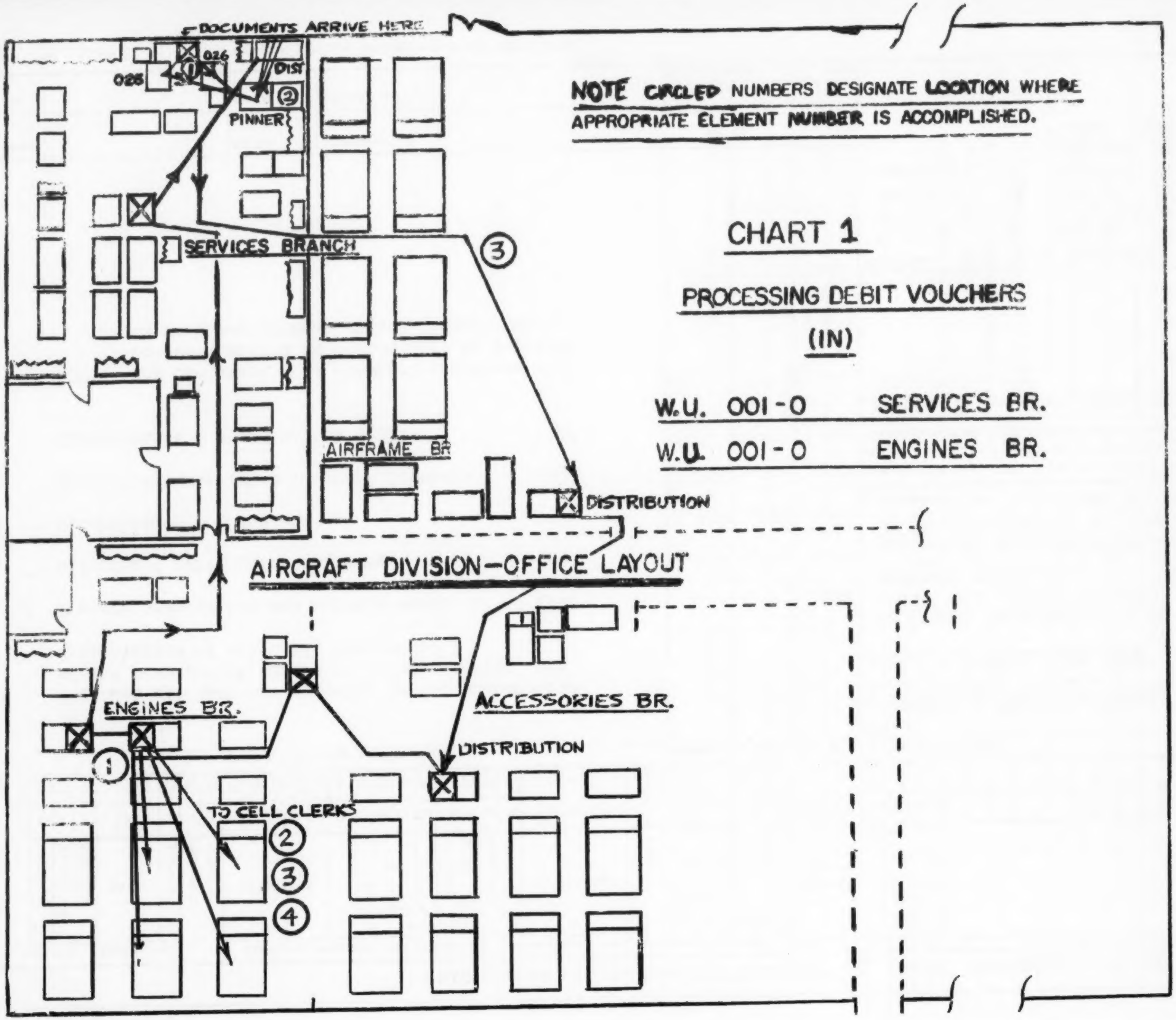
PROCESSING DEBIT VOUCHERS

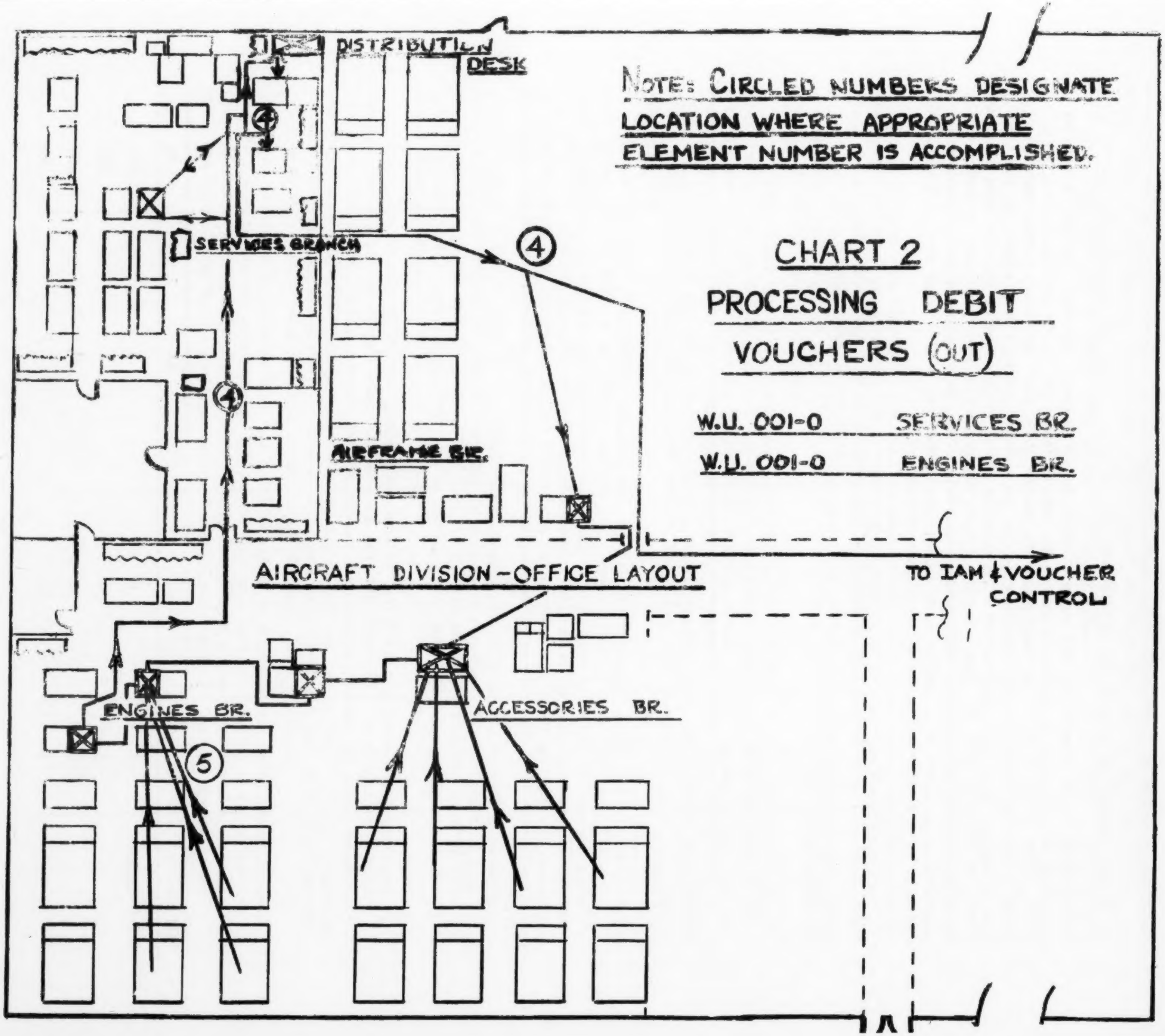
(IN)

W.U. 001-0 SERVICES BR.

W.U. 001-0 ENGINES BR.

NOTE CIRCLED NUMBERS DESIGNATE LOCATION WHERE APPROPRIATE ELEMENT NUMBER IS ACCOMPLISHED.





NOTE: CIRCLED NUMBERS DESIGNATE
LOCATION WHERE APPROPRIATE
ELEMENT NUMBER IS ACCOMPLISHED.
CHART 2
PROCESSING DEBIT
VOUCHERS (OUT)
W.U. 001-0 SERVICES BR.
W.U. 001-0 ENGINES BR.
DISTRIBUTION DESK
SERVICES BRANCH
AIRFRAME BR.
AIRCRAFT DIVISION-OFFICE LAYOUT
TO IAM & VOUCHER CONTROL
ENGINES BR.
ACCESSORIES BR.
4
4
4
5

VI. USES OF MTM IN STANDARD DATA APPLICATION

It may seem from examination of this study that MTM is a slow and unwieldy process for the analyst to use. The amount of research involved to set an MTM standard correctly may seem overwhelming to the layman who has not used MTM to any degree. However, as can be seen by examining the elements of each work unit shown before, things get easier as you go along with MTM. After a few studies have been made, the analyst finds more and more motion patterns repeated. When he finds one of a recurring nature, he merely inserts it in his study as has been done throughout those described before. To show the extent of this type of standard data usage of MTM, the following table has been compiled. Each element within each work unit is broken out by the number of sub-elements, or MTM studies involved. Then, the number of sub-elements taken completely from other MTM studies made earlier are broken out to give some idea of the relative frequency of this short cut in the determination of standards.

WORK UNIT	ELEMENT	#OF SUB-ELEMENTS	#OF SUB-ELEMENTS TAKEN FROM PREVIOUS STUDIES	%
001-0 Services	1	8	0	0
	2	10	0	0
	3	4	0	0
	4	5	0	0
TOTAL		27	0	0
001-0 Engines	1	6	0	0
	2	4	0	0
	3	3	0	0
	4	17	0	0
	5	4	0	0
TOTAL		34	0	0
002-0 Services	1	14	0	0
	2	8	7	87
	3	9	0	0
	4	15	0	0
	5	2	0	0
	6	4	4	100
	7	5	5	100
	8	4	0	0
	9	26	3	12
	10	4	1	25
TOTAL		91	20	22
002-0 Engines	1	6	6	100
	2	4	4	100
	3	3	3	100
	4	14	7	50

APPLICATION I

WORK UNIT	ELEMENT	#OF SUB-ELEMENTS	#OF SUB-ELEMENTS TAKEN FROM PREVIOUS STUDIES	%
	5	9	3	33
	6	3	3	0
	7	3	2	67
	8	3	0	0
	9	4	4	100
TOTAL		49	32	65.3

It can be seen very definitely from such an analysis that as more and more studies are made, more and more interchangeability is found. The table above only includes sub-elements taken totally from some other study. It does not include the many instances when a sequence of motions is repeated within different sub-elements, such as banding a bunch of cards, or picking up a bunch of documents, which may not appear in the above table because other small conditions make the overall sub-element slightly different.

The MTM studies can be used with much greater ease in this type of standard determination, since the starting and ending points of the studies are known exactly. A time study element description does not describe the exact limits of the times involved, and to interchange this type of element freely from one job to another will induce error. However, in an MTM study, if it is found that the limits of the operation being studies differ slightly from the standard data studied, it is a simple matter to adjust the previous pattern with a few MTM motions to bring it to pefect accuracy.

Another advantage of collecting standard data with MTM techniques is the easy reference available. When a time study is completed, and put away into a standard data reference file, it is most difficult for the analyst who performed the study to remember after several months exactly how he did it, what the starting and ending points were, and exactly how the operator he was timing performed the job. With MTM, the analyst can return after any length of time and reconstruct the entire operation completely, just by his knowledge of MTM.

The use of a system such as that which MTM provides is the only way whereby a universal language for describing a job may be used consistently and accurately. Only by means of such a system could a central agency, such as Hq. AMC, in general at quite a distance from its installations, be able to interpret and decipher how a similar job at one installation compares with that of any other installation.

Using a system like MTM, the groundwork could be laid for a comprehensive monitorship of the jobs that provide the largest share of the AMA and AFD workload. When looking at these highly repetitive jobs from an overall AMC standpoint a tremendous amount of money could be saved by just a small reduction in the time necessary to perform one of them. If this monitoring center is to determine and specify the method to be used in a particular job, some universal language is needed, which brings us right around to MTM again.

There are many more advantages that could be gained in standard data accumulation procedures by means of the use of MTM that will not be discussed further here. It is hoped that the previous studies and descriptions will show clearly enough how a finely engineered system like MTM can provide that factual basis for across-the-board application of the best method to be found for any highly repetitive operation.

APPLICATION II

WINCH OPERATION - HOOK and UNHOOK

by

Charles R. Clover
U.S. Naval Ammunition Depot
Concord, California

PART: Powder Box, Projective Box, Salmon Board and Travelling Box

OPERATION: Hook to Winch

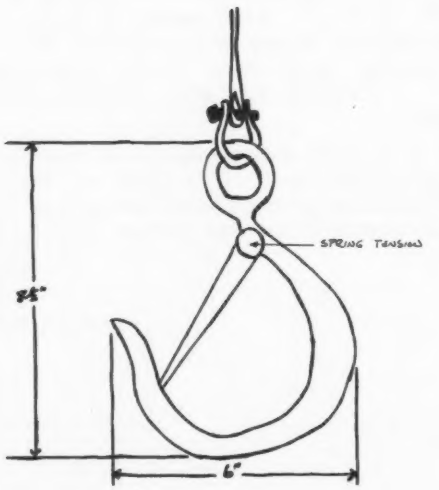
ELEMENT LIST:	Element Time TMU	Occurrences Per Cycle	Total Time Allowed
A. Safety Hooks, Obtain two (Powder Box)	68.8	2	137.6
B. Hook two Hooks (Powder Box)	75.7	2	151.4
C. Walk to Other Side of Box	103.6	1	103.6
D. Step Back from Box	34.0	1	34.0
E. Safety Hooks, Obtain two (Projectile Box)	83.0	2	166.0
F. Hook two Hooks (Projectile Box)	100.8	2	201.6
G. Hook two Hooks (Salmon Board and Travelling Box)	198.2	2	396.4

Total Cycle Time to Hook-up one Powder Box to Winch:	427 TMU	(Elements A,B,C,D)
Total Cycle Time to Hook-up one Projectile Box to Winch:	505 TMU	(Elements C,D,E,F)
Total Cycle Time to Hook-up one Salmon Board and Travelling Box to Winch:	534 TMU	(Elements C,D,G)

Study #9

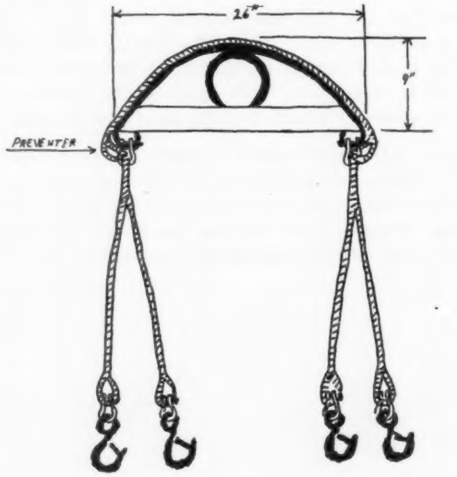
Drawing No. 1

SAFETY HOOK #28



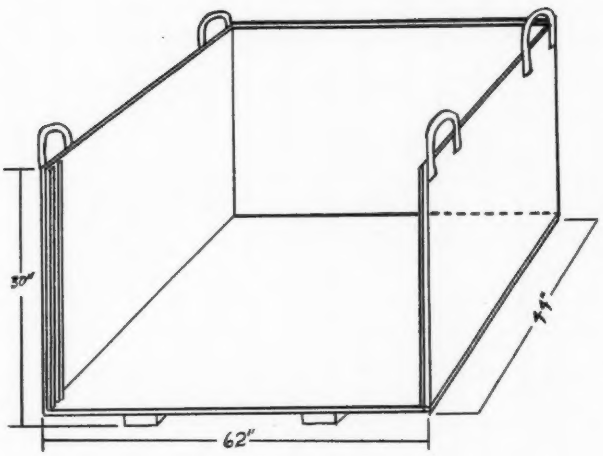
Drawing No. 2

BRIDLE SLING



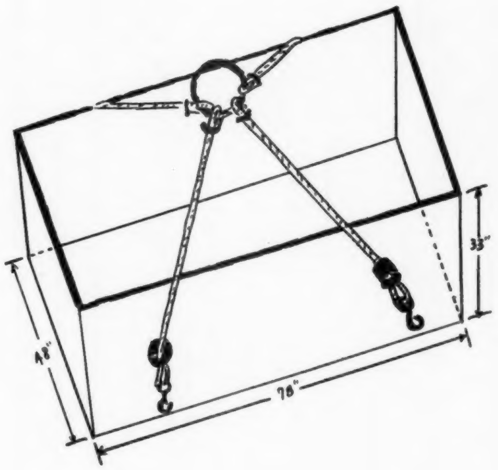
Drawing No. 3

POWDER BOX



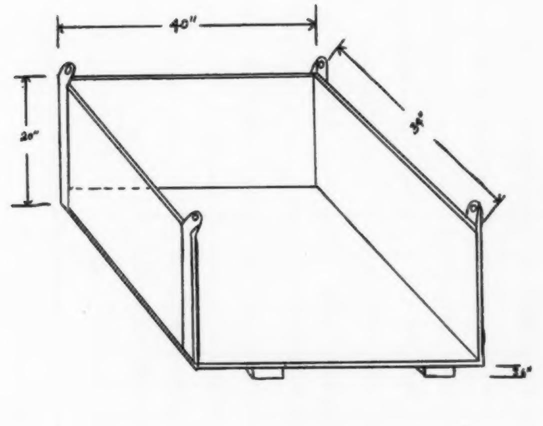
Drawing No. 6

TRAVELING BOX



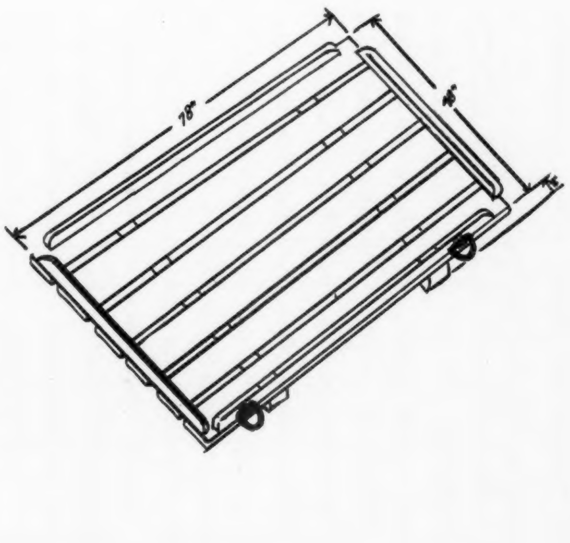
Drawing No. 4

PROJECTILE BOX



Drawing No. 7

SALMON BOARD



METHODS ANALYSIS
NAV. S. AND A. FORM 1053 (11-56)

MONTH AND YEAR: September, 1957

ORGANIZATION AND SUBDIVISION	ANALYST	REFERENCE
	Clover	

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
A. SAFETY HOOKS, OBTAIN TWO (Powder Box)						
			30.0	W2P		To sling on winch hook
For safety hook		R20B	18.6	R20B		For safety hook
Hook		G1A	2.0	G1A		Hook
To side of box		M20B	18.2	M20B		To side of box
			68.8			
B. HOOK TWO HOOKS (Powder Box)						
			13.5	M10C		Hook to eye on box
				~~G2~~		Regrasp Hook
			16.2	AP1		Latch hook
			3.6	M2A		" "
To other end of box		SS18C1	20.6	RL1		Hook
To eye on box		~~M20C~~				
Regrasp hook		~~G2~~				
Latch hook		AP1	16.2			
" "		M2A	3.6			
Hook		RL1	2.0			
			75.7			
C. WALK TO OTHER SIDE OF BOX						
			18.6	TBC1		
			85.0	W5PO		
			103.6			

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METHODS ANALYSIS
NAV. S. AND A. FORM 1053 (11-56)

MONTH AND YEAR: September, 1957

ORGANIZATION AND SUBDIVISION	ANALYST	REFERENCE
	Clover	

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
D. STEP BACK FROM BOX						
			34.0	W2PO		
			34.0			
E. SAFETY HOOKS, OBTAIN TWO (Projectile Box)						
			30.0	W2P		To sling on winch hook
			29.0	B		To hooks
For safety hook		R6B	8.6	R6B		For safety hook
Hook		G1A	2.0	G1A		Hook
To side of box		M12B	13.4	M12B		To side of box.
			83.0			
F. HOOK TWO HOOKS (Projectile box)						
			10.3	M6C		Hook to eye on box
				~~G2~~		Regrasp Hook
			16.2	AP1		Latch hook
			3.6	M2A		" "
To other end of box		SS12C1	17.0	RL1		Hook
Hook to eye on box		~~M6C~~				
Regrasp hook		~~G2~~				
Latch hook		AP1	16.2			
" "		M2A	3.6			
Hook		RL1	2.0			
			31.9	AB		Arise
			100.8			

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METHODS ANALYSIS
NAV. S. AND A. FORM 1053 (11-56)

MONTH AND YEAR: September, 1957

ORGANIZATION AND SUBDIVISION | ANALYST: Clover | REFERENCE

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
G. HOOK TWO HOOKS (Salmon Board and Travelling Box)						
			29.0	S		To hook
			8.6	R6B		To hook
			2.0	G1A		Hook
			13.4	MFB3		Lift hook
			5.6	G2		Regrasp hook
			10.6	AP2		Open latch on hook
			2.5	M1A		" " " "
			3.6	M2A		Push hook on eye
			2.0	RL1		Hook
			40.7	SS1C2		To other end of box
To hook		R6B	8.6			
Hook		G1A	2.0			
Lift hook		MFB3	13.4			
Regrasp hook		G2	5.6			
Open latch on hook		AP2	10.6			
" " " "		M1A	2.5			
Push hook on eye		M2A	3.6			
Hook		RL1	2.0			
			31.9	AS		Arise
			198.2			

C33926

PART : Powder Box, Projectile Box, Salmon Board and Travelling Box

OPERATION: Unhook from Winch

ELEMENT LIST:	Element Time TMU	Occurrences Per Cycle	Total Time Allowed
A. Powder Box, Unhook two hooks	152.1	2	304.2 - 27.0 277.2
B. Walk to other side of box	103.6	1	103.6
C. Projectile Box, Unhook two hooks	213.0	2	426.0 - 27.0 399.0
D. Salmon Board and Travelling Box, Unhook two hooks	232.6	2	426.2 - 27.0 438.2

Note: 27.0 TMU is deducted from the total time allowed in elements A, C, and D because this allowance for process time occurs only once per cycle.

Total Cycle Time to Unhook one Powder Box from Winch: 381 TMU (Elements A, B)

Total Cycle Time to Unhook one Projectile Box from Winch: 503 TMU (Elements B, C)

Total Cycle Time to Unhook one Salmon Board from Travelling Box (Elements B,D): 542 TMU

METHODS ANALYSIS
NAV. S. AND A. FORM 1053 (11-56)

MONTH AND YEAR: September, 1957

ORGANIZATION AND SUBDIVISION	ANALYST	REFERENCE
	Clover	

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
A. POWDER BOX, UNHOOK TWO HOOKS						
To top of hook		R44B	34.1	R8B		To back of hook
				G5		Hook with palm
				R3B		To latch with fingers
				G1A		Latch
Top of hook		G1A	2.0			
			27.0	PT		Signal for more slack in sling and wait for winch operation.
						Average duration: 162 TMU
						Frequency: 1 in 6
Pull hook taut		M2A	3.6			
			10.6	AP2		Open latch
			2.5	M1A		" "
Free hook		M4B	6.9	M4B		Free hook
Hook		RL1	2.0	RL1		Hook
			18.6	TBC1		To other hook
To back of hook		R10B	17.2	R18B		To top of hook
Hook with palm		G5				
To latch with fingers		R3B				
Latch		G1A	2.0	G1A		Top of hook
			3.6	M2A		Pull hook taut
Open latch		AP2	10.6			
" "		M1A	2.5			
Free hook		M4B	6.9	M4B		Free hook
Hook		RL1	2.0	RL1		Hook
			152.1			

Page

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METHODS ANALYSIS
NAV. S. AND A. FORM 1053 (11-56)

MONTH AND YEAR: September, 1957

ORGANIZATION AND SUBDIVISION	ANALYST	REFERENCE
	Clover	

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
B. WALK TO OTHER SIDE OF BOX						
			18.6	TBC1		
			85.0	W5PO		
			103.6			
C. PROJECTILE BOX, UNHOOK TWO HOOKS						
			152.1			Same motion pattern Element A
			29.0	B		Bend to box
			31.9	AB		Arise
			213.0			
D. SALMON BOARD AND TRAVELLING BOX, UNHOOK TWO HOOKS						
			152.1			Same motion pattern Element A
			29.0	S		Stoop to box
			31.9	AS		Arise
			19.6	M3A	4	Additional moves to free twisted hooks.
			232.6			

Page

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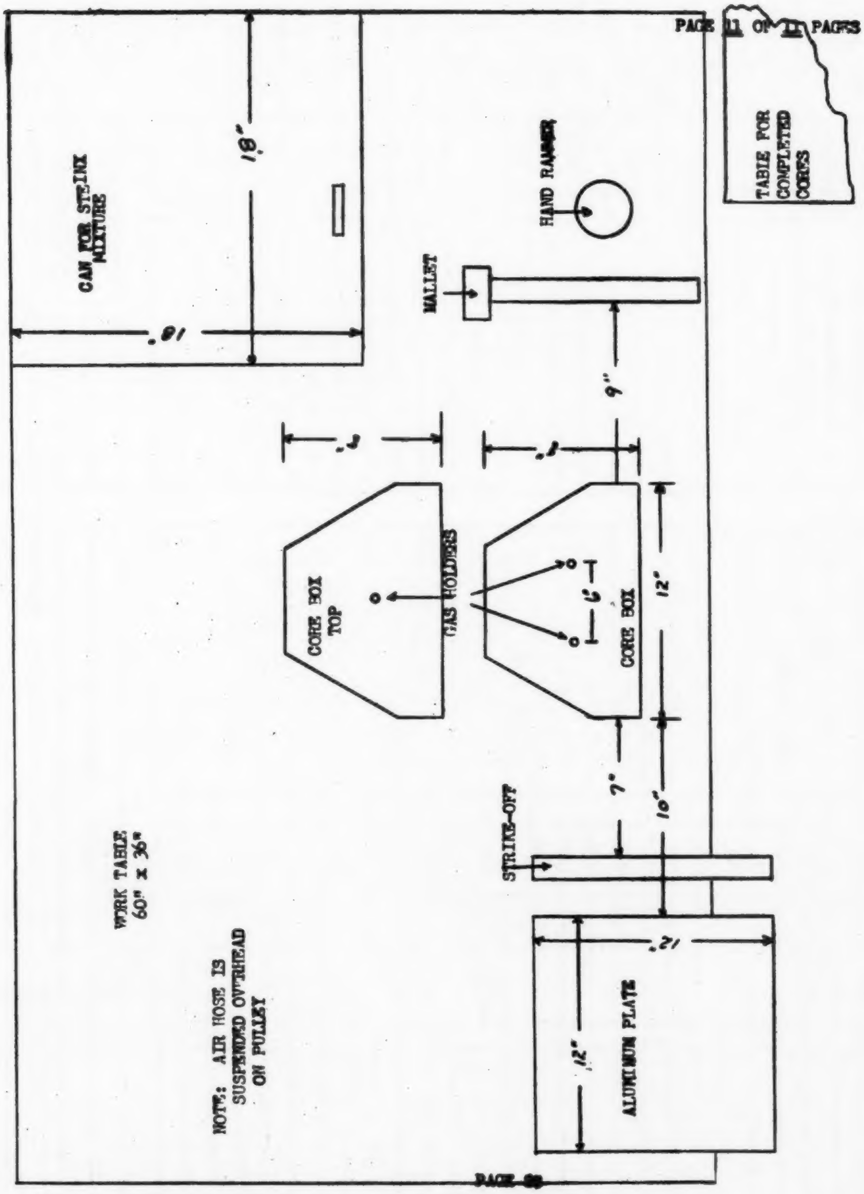
APPLICATION III

CORE MAKING (CRANKSHAFT BASE CORE)

by

Donald G. Morse
Sacramento Air Materiel Area
U.S.A.F.
McClellan Air Force Base
McClellan, California



WORK PLACE LAYOUT

WORK MEASUREMENT METHODS ANALYSIS CHART

REFERENCE NO.

PART: CRANKSHAFT BASE CORE — DATE: 1-9-58 — STUDY NO. 40-7

OPERATION: CORE MAKING — ANALYST: MORSE — PAGE 1 OF 11 PAGES

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
1. PLACE 2 SCOOPS OF STEINX AND MIXTURE IN CORE BOX						
REACH FOR LID		R28B	24.4	R16		HAND TO NEAR CAN
GRASP LID		G1A	2.0			
RAISE LID		M8B	10.6			
			11.5	R10B		REACH FOR SCOOP
			2.0	G1A		GRASP SCOOP
			6.9	M4B		LIFT SCOOP
			8.9	M6B		MOVE SCOOP IN SAND
			23.1	M28B		MOVE SAND TO CORE BOX
			9.4	T180S		DUMP SAND
			23.1	M28B		MOVE SCOOP INTO SAND
			23.1	M28B		MOVE SCOOP TO BOX
			9.4	T180S		DUMP SAND
			18.2	M20B		MOVE SCOOP TO CAN
			2.0	RL1		RELEASE SCOOP
RELEASE LID		RL1	6.8	R4E		HAND OUT OF CAN
			181.4			

NO.	ELEMENT DESCRIPTION	ELEMENT TIME TMU	CONVERSION FACTOR / LEVELED TIME	% ALLOWANCE	ELEMENT TIME ALLOWED	OCCURRENCES PER PIECE OR CYCLE	TOTAL TIME ALLOWED
						TOTAL	

AMC FORM 19 MAY 58 142AL (REPRODUCED BY PERMISSION OF THE METHODS ENGINEERING COUNCIL) AF-WP-O-26 NOV 56 55M

WORK MEASUREMENT METHODS ANALYSIS CHART

REFERENCE NO.

PART: CRANKSHAFT BASE CORE — DATE: 1-9-58 — STUDY NO. 40-7

OPERATION: CORE MAKING — ANALYST: MORSE — PAGE 2 OF 10 PAGES

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
2. TUCK SAND INTO CORNERS WITH FINGERS AND TAMP WITH MALLET HANDLE						
REACH TO CORE BOX		R30B	25.8	R20B		REACH TO CORE BOX
TUCK SAND AROUND	9	M3B	51.3	M3B	9	TUCK SAND AROUND
EDGE WITH FINGERS	9	AP1	145.8	AP1	9	EDGE WITH FINGERS
TO REST		R6E	11.5	R10B		REACH FOR MALLET
			2.0	G1A		GRASP MALLET
			12.2	M10B		MOVE MALLET TO CORE BOX
			147.2	M2B	32	TAMP SAND
			115.2	M2A	32	TAMP SAND
			12.2	M10B		MOVE MALLET TO BENCH
			2.0	RL1		RELEASE MALLET
			525.2			

NO.	ELEMENT DESCRIPTION	ELEMENT TIME TMU	CONVERSION FACTOR / LEVELED TIME	% ALLOWANCE	ELEMENT TIME ALLOWED	OCCURRENCES PER PIECE OR CYCLE	TOTAL TIME ALLOWED
						TOTAL	

AMC FORM 19 MAY 58 142AL (REPRODUCED BY PERMISSION OF THE METHODS ENGINEERING COUNCIL) AF-WP-O-26 NOV 56 55M

WORK MEASUREMENT METHODS ANALYSIS CHART

PART: CRANKSHAFT BASE CORE | DATE: 1-9-58 | REFERENCE NO. | STUDY NO. 40-7
OPERATION: CORE MAKING | ANALYST: MORSE | PAGE 3 OF 10 PAGES

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
3. PLACE THREE MORE SCOOPS OF STEINX AND MIXTURE IN CORE BOX						
REACH FOR LID		R28B	24.4	M10B		HAND TO NEAR CAN
GRASP LID		G1A	2.0			
RAISE LID		M8B	10.6			
			11.5	R10B		REACH FOR SCOOP
			2.0	G1A		GRASP SCOOP
			6.9	M4B		LIFT SCOOP
			8.9	M6B		MOVE SCOOP IN SAND
			23.1	M28B		MOVE SAND TO CORE BOX
			9.4	T180S		DUMP SAND
			23.1	M28B		MOVE SCOOP INTO SAND
			23.1	M28B		MOVE SCOOP TO BOX
			9.4	T180S		DUMP SAND
			23.1	M28B		MOVE SCOOP INTO SAND
			23.1	M28B		MOVE SAND TO BOX
			9.4	T180S		DUMP SAND
			18.2	M20B		MOVE SCOOP TO CAN
			2.0	RL1		RELEASE SCOOP
			230.2			

NO.	ELEMENT DESCRIPTION	ELEMENT TIME TMU	CONVERSION FACTOR / LEVELED TIME	% ALLOWANCE	ELEMENT TIME ALLOWED	OCCURRENCES PER PIECE OR CYCLE	TOTAL TIME ALLOWED

PAGE 80 | TOTAL

AMC FORM 19 MAY 55 142AL (REPRODUCED BY PERMISSION OF THE METHODS ENGINEERING COUNCIL) AF-WP-O-26 NOV 56 55M

WORK MEASUREMENT METHODS ANALYSIS CHART

PART: CRANKSHAFT BASE CORE | DATE: 1-9-58 | REFERENCE NO. | STUDY NO. 40-7
OPERATION: CORE MAKING | ANALYST: MORSE | PAGE 4 OF 11 PAGES

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
4. TAMP STEINX MIXTURE WITH HANDLE OF MALLET AND HAND RAMMER						
RELEASE LID		RL1	15.8	R16B		REACH FOR MALLET
HAND ASIDE		R28E	2.0	G1A		GRASP MALLET
			12.2	M10B		MOVE MALLET TO SAND
			147.2	M2B	32	TAMP SAND
			115.2	M2A	32	
			12.2	M10B		MOVE MALLET TO BENCH
			2.0	RL1		RELEASE MALLET
MOVE HAND TO CORE		R6B	11.5	R10B		MOVE HAND TO CORE
GRASP		G5	0.0	G5		GRASP
SPREAD SAND	4	M5B	32.0	M5B	4	SPREAD SAND
RELEASE SAND		RL2	0.0	RL2		RELEASE SAND
TO REST		R6E	13.7	R13B		REACH FOR HAND RAMMER
			2.0	G1A		GRASP RAMMER
			14.0	M13B		MOVE RAMMER TO CORE
			103.5	M4B	15	TAMP SAND
			91.5	M4A	15	
REACH FOR STRIKE-OFF		R6B	8.9			
GRASP STRIKE-OFF		G1A	2.0			
MOVE STRIKE-OFF TO RAMMER		M10B	12.2	M4B T45s		LIFT RAMMER
STRIKE-OFF SAND	10	M4B	69.0			
			14.0	M13B ~~T45~~		MOVE RAMMER TO BENCH
			2.0	RL1		RELEASE
			682.9			

NO.	ELEMENT DESCRIPTION	ELEMENT TIME TMU	CONVERSION FACTOR / LEVELED TIME	% ALLOWANCE	ELEMENT TIME ALLOWED	OCCURRENCES PER PIECE OR CYCLE	TOTAL TIME ALLOWED

PAGE 81 | TOTAL

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WORK MEASUREMENT METHODS ANALYSIS CHART

PART: CRANKSHAFT BASE CORE | DATE: 1-9-58 | REFERENCE NO. | STUDY NO. 40-7
OPERATION: CORE MAKING | ANALYST: MORSE | PAGE 9 OF 11 PAGES

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
9. REMOVE CORE BOX AND ASIDE WITH CORE						
TO REST		R26E	11.4	M3B	2	STRIKE BOX
			9.8	M3A	3	
			10.6	M8B		MOVE MALLET TO BENCH
			2.0	RL1		RELEASE MALLET
REACH FOR BOX		R6B	11.5	R10B		REACH FOR BOX
GRASP BOX		G1A	2.0	G1A		GRASP BOX
REMOVE BOX	10	M1C	34.0	M1C	10	REMOVE BOX
MOVE BOX TO BENCH		M12B	13.4	M12B		MOVE BOX TO BENCH
TURN BOX OVER		~~G2~~		~~G2~~		TURN BOX OVER
RELEASE BOX		G5	0.0	G5		RELEASE BOX
REACH FOR CORE		R12B	12.9	R12B		REACH FOR CORE
GRASP CORE		G1A	2.0	G1A		GRASP CORE
			18.6	TBC1		MOVE CORE ASIDE
MOVE CORE TO TABLE		M12C		~~M20~~		MOVE CORE TO TABLE
RELEASE CORE		RL1	2.0	RL1		RELEASE CORE
			18.6	TBC1		TURN BACK TO BENCH
REACH FOR PLATE		R6B		~~R6B~~		REACH FOR PLATE
GRASP PLATE		G1A	2.0	G1A		GRASP PLATE
SLIDE PLATE ASIDE		M22B	19.4	M22B		SLIDE PLATE ASIDE
RELEASE PLATE		RL1	2.0	RL1		RELEASE
REACH TO CORE BOX		R30B	25.8	R26B		
GRASP		G1A	2.0	G1A		GRASP BOX
BOX TO WORK AREA		M12B	13.4	M12B		BOX TO WORK AREA
RELEASE		RL1	2.0	RL1		RELEASE
			215.4			

NO.	ELEMENT DESCRIPTION	ELEMENT TIME TMU	CONVERSION FACTOR / LEVELED TIME	% ALLOWANCE	ELEMENT TIME ALLOWED	OCCURRENCES PER PIECE OR CYCLE	TOTAL TIME ALLOWED

PAGE 86 | TOTAL

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WORK MEASUREMENT OPERATION SUMMARY

PART: CRANKSHAFT BASE CORE | DATE: 1-9-58 | STUDY NR 40-7
OPERATION: CORE MAKING | ANALYST: MORSE | PAGE 10 OF 11 PAGES

NR	ELEMENT DESCRIPTION	ANALYSIS CHART REF	ELEMENT TIME TMU	CONVERSION FACTOR .00001 LEVELED TIME	% ALLOWANCE	ELEMENT TIME ALLOWED	OCCURRENCES PER PIECE OR CYCLE	TOTAL TIME ALLOWED
1.	PLACE 2 SCOOPS OF STEINX MIXTURE IN CORE BOX	1	181.4	.001814	15%	.002086	1/1	.002086
2.	TACK SAND MIXTURE INTO CORNERS AND TAMP WITH MALLET HANDLE	2	525.2	.005252	15%	.006040	1/1	.006040
3.	PLACE THREE MORE SCOOPS OF STEINX MIXTURE IN CORE BOX	3	230.2	.002302	15%	.002647	1/1	.002647
4.	TAMP STEINX MIXTURE WITH HANDLE OF MALLET AND HAND RAMMER	4	682.9	.006829	15%	.007853	1/1	.007853
5.	"STRIKE-OFF" CORE	5	152.6	.001526	15%	.001755	1/1	.001755
6.	GAS TOP OF CORE	6	558.0	.005580	15%	.006417	1/1	.006417
7.	OBTAIN ALUMINUM PLATE AND TURN CORE UPSIDE DOWN	7	124.0	.001240	15%	.001426	1/1	.001426
8.	GAS BOTTOM OF CORE	8	855.6	.008556	15%	.009839	1/1	.009839
9.	REMOVE CORE BOX AND ASIDE WITH CORE	9	215.4	.002154	15%	.002477	1/1	.002477

PAGE 87 | TOTAL TIME ALLOWED PER — .040540

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Naval Supply Center, Oakland, Calif.
February 1958

Eighteen civilian employees of the Oakland Naval Supply Center have successfully completed a six-week course in Methods-Time Measurement and Methods Engineering.

CDR F. J. Roberts, Planning Officer and Comptroller for the Supply Center, presented Navy Certificates of Training and MTM Association Certificates of Recognition to the graduates during ceremonies held in the Assembly Hall of the Administration building.

This was the third course in Methods-Time Measurement and the second course that has included training in methods engineering that has been given here. The first course in MTM and ME was given in January 1956, and inaugurated the Center's Engineered Time Standards (ETS) Program. The ETS Program has been installed in various naval supply activities and is sponsored by the Bureau of Supplies and Accounts in Washington, D.C. The Bureau of Supplies and Accounts is a member of the MTM association.

The recent three-week course in MTM was instructed by Daniel Markoff, of the Bureau of Supplies and Accounts. The methods engineering portion of the course was a combined effort of Center and Bureau personnel. Carl Kern, of the Center's ETS Branch, instructed the students in Process Charting, and Carl Willnecker, also of the Center's ETS staff, taught Time Study. Work Sampling was presented by Marvin H. Danziger, of the Bureau's Director of Management Engineering Office. John Schanzenbach, also from the Bureau's Management Engineering Office, gave the group instruction on operation and motion analysis, methods improvement, and application of techniques to standard setting and reporting requirements. Mr. Schanzenbach and Mr. James A. Daniel, Engineered Time Standards Director for the Oakland Supply Center, coordinated the course program.

The students that were selected to receive the training represented practically every major component that comprises the Supply Center.

Eighteen civilian employees of the Supply Center successfully completed a six-week course in Methods-Time Measurement and Methods Engineering. CDR F.J. Roberts, Planning Officer and Comptroller for the Center (front row), presented Navy Certificates of Training and MTM Association Certificates of Recognition to the graduates. In addition to CDR Roberts, the front row includes, from left: instructor Marvin Danziger, Dorothy Anderson, Mildred Crawford, Concha Meagher, Jane DeSchane, Roberta Olsen, instructor John Schanzenbach. Middle row: instructor Carl Willnecker, Bruce Johnson, Justin Brainerd, William Davis, William MacTavish, Max Harn, Rupert Hansen, Clarence Emmans, instructor Carl Kern. Back row: George Yokoyama, Fred Gisse, David Furnanz, Leo Cooney, Ray Horne, Angelo Colapietro.

The Planning and Comptroller Department was represented by: Leo Cooney, David Furnanz, Justin Brainerd; Rupert Hansen, Ray Horn and Concha Meagher; Freight Terminal Department—Dorothy Anderson and Angelo Colapietro; General Supply Depot—Mildred Crawford and George Yokoyama; Aviation Supply Depot—William Davis and Roberta Olsen; Industrial Relations Department—Jane De Schane; Ordnance Supply Depot—Clarence Emmans; Material Services Department—Fred Gisse; Administrative Services Department—Max Harn; Ships Supply Depot—Bruce Johnson and William MacTavish.

Those students that will not apply MTM as a regular part of their job will be called upon to assist the ETS analysts as the methods and standards work is scheduled in their departments.

Daniel Markoff, of the Navy Department's Bureau of Supplies and Accounts, is seen at work during the six-week course in Methods-Time Measurement and Methods Engineering. Mr. Markoff taught the MTM phase of the course. Students in the picture are, from left: Mildred Crawford, Jane De Shane, Dorothy Anderson, Angelo Colapietro, Clarence Emmans, and Roberta Olsen.

ANNOUNCEMENT

EVENT	Annual Cornell University Industrial Engineering Seminars
SPONSOR	Department of Industrial and Engineering Administration, Sibley School of Mechanical Engineering, Cornell University
PLACE	Cornell University, Ithaca, New York
TIME	June 17 through June 20, 1958
OBJECTIVES	These seminars provide an opportunity for critical study and reappraisal of some of the major problems of manufacturing planning and control.
PROGRAM	A series of seminar discussions covering each of the following seven areas: A) Industrial Management B) Manufacturing Engineering C) Small Plant Management D) Methods Engineering E) Applied Industrial and Engineering Statistics F) Statistical Aspects of Component Reliability G) Data Processing Systems In addition, all participants attend several general sessions.
DISCUSSION LEADERS AND SPEAKERS	Specialists from both industry and the staff of Cornell University
FOR WHOM?	Operating management personnel in line supervision and staff positions in industrial engineering, production engineering, research and development, quality control, cost accounting and cost reduction, production control, materials control, purchasing, data processing, and personnel administration.

For additional information contact:

Andrew Schultz, Jr.
Department of Industrial and Engineering Administration
Cornell University
Ithaca, New York

RESEARCH REPORTS

R.R. 101 Disengage

This report contains a preliminary study of the element disengage. While it is still classified as tentative, the report contains some extremely interesting conclusions on the nature and theory of this element.

R.R. 102 Reading Operations

The first step in the use of MTM for establishing reading time standards is contained in this report. In addition, the report contains a synopsis of the work done in this field by 11 leading authorities.

R.R. 104 MTM Analysis of Performance Rating Systems

A talk presented at the SAM-ASME Time and Motion Study Conference, April 1952. It contains an analysis of performance rating systems and various performance Rating Films from an MTM standpoint.

R.R. 105 Simultaneous Motions

This report represents almost two man-years' work on a study of Simultaneous Motions. It is a final report of the Simultaneous Motions project undertaken by the MTM Association. While it does not purport to provide complete and exhaustive answers to all problems in the field of Simultaneous Motions, it presents a great deal of new and valuable information which should be of interest to every MTM practitioner.

R.R. 106 Short Reaches and Moves

This report contains an analysis of the characteristics of Reaches and Moves at very short distances. It develops important conclusions concerning the application of MTM to operations involving these short distance elements.

R.R. 107 A Research Methods Manual

The research activity of the Association has developed an effective and comprehensive set of methods for carrying on research in human motions. This report details the major techniques used. Adequate sources of motion data, film analysis, data recording, and statistical methods of analysis are among the topics discussed.

R.R. 108 A Study of Arm Movements Involving Weight

In this report, the results of a large investigation into the effect of weight on the performance times of arm movements are presented. While more effective means of determining correct time allowances for moving weights are given, the comprehensive discussion of the whole area of weight phenomena is probably of more fundamental importance. The effect of such conditions of performance as the use of one or two hands, sliding vs. spatial movements, and male and female performance are among the topics presented.

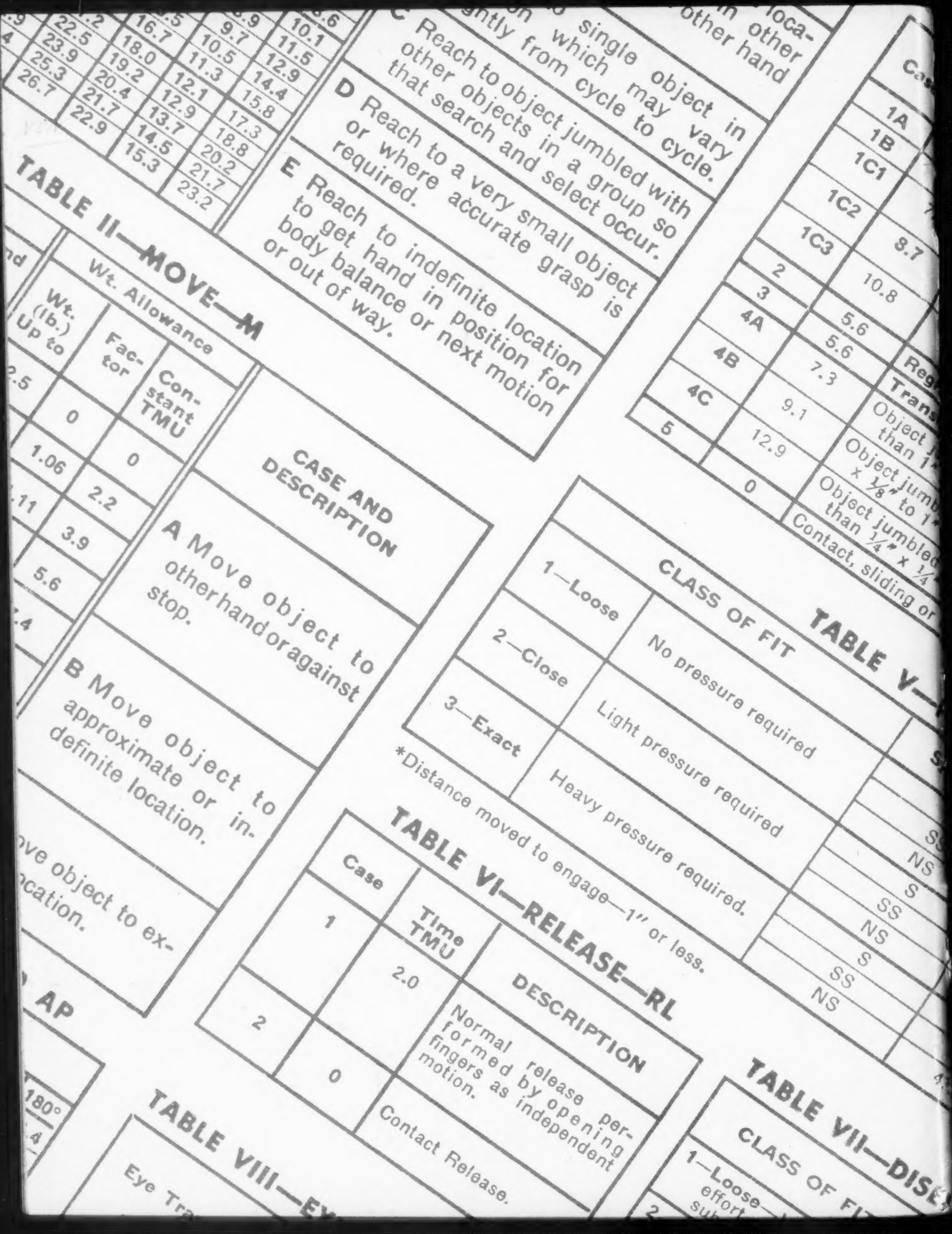

TABLE II—MOVE—M
Wt. Allowance
Wt. (lb.) Up to
Fac-tor
Con-stant TMU
CASE AND DESCRIPTION
A Move object to other hand or against stop.
B Move object to approximate or indefinite location.
ove object to ex-
cation.
Reach to object jumbled with other objects in a group so that search and select occur.
D Reach to a very small object or where accurate grasp is required.
E Reach to indefinite location to get hand in position for body balance or next motion or out of way.
single object in
which may vary
from cycle to cycle.
other hand
1A
1B
1C1
1C2
1C3
2
3
4A
4B
4C
5
8.7
10.8
5.6
5.6
7.3
9.1
12.9
0
TABLE V—
CLASS OF FIT
1—Loose
No pressure required
2—Close
Light pressure required
3—Exact
Heavy pressure required.
*Distance moved to engage—1" or less.
TABLE VI—RELEASE—RL
Case
Time TMU
DESCRIPTION
1
2.0
Normal release performed by opening fingers as independent motion.
2
0
Contact Release.
TABLE VII—DIS
CLASS OF FI
1—Loose
effort
TABLE VIII—EY
Eye Tra
AP
180°

Cas
A
8.7
Reg
Trans
ject j
an 1
jumb
to 1
mbled
x 1/4
ing or
V—
S
SS
NS
S
DISE